# ANNUAL RESEARCH REPORT

## 2002-03


**ON-FARM RESEARCH DIVISION**

**BANGLADESH AGRICULTURAL RESEARCH INSTITUTE**

**GAZIPUR 1701**

# Annual Research Report
## 2002-03


***Program Leader***

*Dr. M Abu Sufian*

***Compiled and edited by***

*Dr. M A Quayyum*
*Dr. Mustaque Ahmed*
*Dr. M Yusuf Ali*
*Dilwar A Choudhury*
*M Akhtar Hossain*

***Word Processed by***

*S. M. Obaidur Rahman*
*M Abdul Jabber*



**ON-FARM RESEARCH DIVISION**
**Bangladesh Agricultural Research Institute**
**Gazipur 1701**

## Preface

On-Farm Research Division (OFRD) of Bangladesh Agricultural Research Institute (BARI) is going to publish the research reports of experiments conducted during 2001-02 and rabi season 2002-03 at different Farming System Research and Development (FSRD) and Multilocation Testing (MLT) sites across the country. The mandate of OFRD is to conduct research for the improvement of existing farming system and testing and validation of on-station technologies under a wide range of agro-climatic situation for the fine tuning. In this regard, major thrust was given on the improvement of existing cropping systems through introduction of improved varieties, crop management as well as soil fertility management practices.

Emphasis was also given in improvement of existing cropping system practiced by the farmers' with introduction of new crops and varieties for coastal, rainfed and hill areas to develop suitable technologies for the problematic soils of Bangladesh. Similarly, Soil fertility management is another important issue need to be addressed comprehensively for sustainable crop production. Priority was given on cropping pattern based balanced fertilization for major AEZs and integrated plant nutrient management (IPNS) to maintain and improve soil fertility. Research report on Socio-economic studies, Integrated farming and On-farm verification of advanced lines and technologies were also included in this report.

I hope this report will be very useful to the researchers, GO, NGO and extension personnel working in this field.

Dr. M Abu Sufian
Chief Scientific Officer
OFRD, BARI, Gazipur

# CONTENTS

| Project | Title of the Experiments |
|---|---|
| | Adaptive yield trial of Barley for coastal area |
| **Rainfed farming** | |
| | Response of T.Aman-Chickpea cropping pattern to applied phosphorus in the High Barind Tract, Bangladesh |
| | Performance of five drought tolerant and wilt resistant Chickpea genotypes under High Barind conditions |
| | Advanced yield trail of Chickpea |
| | Study on the seed enrichment of Mustard with boron to minimize boron deficiency in the soil |
| **Hill farming** | |
| | Intercropping carrot with hybrid maize at different planting systems at hilly areas in Bandarban |
| | Inter-cropping of hybrid maize with Bushbean at different fertilizer levels in Bandarban |
| | An adaptive trial of different varieties of Potato at hilly areas in Bandarban |
| | On-farm trial of BARI Chickpea varieties at hilly areas in Bandarban |
| | On-farm trial of BARI Stem amaranth variety at hilly areas in Bandarban |
| | Feasibility study of pointed gourd at hilly areas in Bandarban |
| **On-farm trials with advance lines and technologies** | |
| | On-farm adaptability trial of some promising rape Mustard varieties/lines |
| | Farmers field trial of Chickpea |
| | On-farm trial to evaluate the effect of seed source on BGM incidence in BARI Chola-5 |
| | Bread Wheat adaptive line trials at farmers' field condition |
| | Performance of wheat through Power seeder compare to traditional method |
| | On-farm verification trial of Hybrid maize |
| | On-farm trial of Radish varieties |
| | On-farm trial of Tomato varieties |
| | On-farm trial of early Brinjal variety |
| | Dissemination of newly improved varieties of Panikachu |
| | Dissemination of newly improved varieties of Mukhikachu |
| | Adaptive trial of developed and advance lines of Groundnut at farmers' field |
| | Dissemination of newly improved varieties of Sweet potato |
| **Studies of Socio-economics** | |
| | A study on farmer's practice of growing Lotkon (Baccaurea sapida) at Shibpur, Narsingdi |
| | Yield gap analysis of Potato under different management situation in Bandarban area |
| | Yield gap analysis of wheat under different management situation at FSRD site, Goyeshpur, Pabna |
| | Fertilizer management in major cropping patterns at Jessore and Panchagarh District |
| **Integrated Farming** | |
| | Narikeli, Jamalpur |
| | Goyeshpur, Pabna |
| | Golapganj, Sylhet |
| | Lebukhali, Patuakhali |
| | Palima, Tangail |
| **Technology Transfer** | |
| **Appendix** | |
| | List of Scientists involved with On-Farm Research Division |

## Subproject: Cropping Pattern Based Fertilizer Management

# DEVELOPMENT OF FERTILIZER RECOMMENDATION FOR DIFFERENT CROPPING PATTERNS AND ENVIRONMENTS


### Abstract

The experiment was conducted at different locations covering the major AEZs of the country to develop a cropping pattern based fertilizer recommendation for dominant cropping patterns under different AEZ. A total of 16 (sixteen) dominant cropping patterns across the country were tested against six different fertilizer management packages (soil test based fertilizer dose for MYG & HYG, IPNS for HYG, FRG ’97, farmers practice and absolute control). In general, higher yield as well as gross margin was recorded from STB fertilizer dose for HYG ($T_2$) and IPNS ($T_3$) treatment over the locations. But marginal benefit cost ratio (MBCR) over control was higher in AEZ based fertilizer recommendation (FRG ’97) and in STB fertilizer dose for MYG & HYG as well. In IPNS treatment due to cost of organic manure MBCR was less compared with other treatments. At some locations the experiment was completed for three cycles and recommendation were made and considering yield, economic return and long term soil fertility management were suggested for different cropping patterns.


### Introduction

Soil fertility is a dynamic property which varies with crops, cropping intensity and input use. More than 50% of our cultivated soil contain organic matter below the critical level (1.5%). Annual depletion of plant nutrients in the intensively cropped area ranges from 180 to more than 250 kg/ha. High and medium highland comprising 60% of total cultivated land which is in most cases deficient in essential nutrients such as nitrogen, phosphorus, potassium and sulphur. The low organic matter content, higher cropping intensity, improper cropping sequence and faulty management practices are the major causes of depletion of soil fertility. Imbalance use of fertilizers is another serious problem for the country. Previous survey revealed that farmers in many areas in Bangladesh applied nitrogenous fertilizer higher than the recommended dose for some crops. They usually did not use any organic fertilizers. Scarcity of fuel led them to use cowdung and crop residues as domestic fuel. Farmers usually use of fertilizers on single crop basis without considering the whole cropping pattern. But some of the nutrients by now knew to have considerable residual effect on the succeeding crops. Recently BARC developed a national fertilizer recommendation guide '97 that needs to be further updated and verified for different dominant cropping patterns at different environments. Therefore, it is very important to develop a cropping pattern based fertilizer recommendation under different agro-ecological conditions.

**Objectives**

- To find out a cropping pattern based fertilizer recommendation for dominant cropping patterns
- To determine the economic use of fertilizer in promising pattern

### Materials and Methods

The experiment was conducted at different locations under different AEZs on different cropping patterns during 2001-02. A total of 16 dominant cropping patterns were tested at 34 different locations. The experiment was laid out in RCB design with six dispersed replications. The following six fertilizer management packages were tested-

| | | |
|---|---|---|
| $T_1$ (ED1) | = | Estimated mineral fertilizer dose for moderate yield goal |
| $T_2$ (ED2) | = | Estimated mineral fertilizer dose for high yield goal |
| $T_3$ (INM) | = | Integrated Nutrient Management for HYG |
| $T_4$ (FRG ‘97) | = | Fertilizer dose from BARC Fertilizer Recommendation Guide’97 |
| $T_5$ (FP) | = | Farmers’ practice |
| $T_6$ (Control) | = | Absolute control |

The treatment concept was to compare the soil test based (STB) mineral fertilizer dose for High Yield Goal (HYG), Moderate Yield Goal (MYG), the high yield goal integrated with organic manure with current BARC's Fertilizer Recommendation Guide '97 as well as the farmers prevailing practices. Details of the site characteristics and crop management are given in appendix table 1 & 2. The different cropping patterns studied at different locations are as follows-

**Different cropping patterns tested in different locations**

| Sl # | Cropping pattern | Location |
|---|---|---|
| 1. | Mustard-Boro-T.Aman | Melandah, Muktagacha, Gabtali, Bagherpara |
| 2. | Wheat-Jute-T.Aman | Sherpur, Kishoregonj, Goyeshpur |
| 3. | Boro-T.Aman | Kendua, Phulpur, Netrokona, Laksam, Ishan Gopalpur, Sujanagar, Kolaroa, Satkaniya, Joypurhat, |
| 4. | Potato-Jute-T.Aman | Narikeli |
| 5. | Groundnut-T.Aman | Laxmipur, Atkopalia, Natore |
| 6. | Potato-T.Aman | Barind, Paba |
| 8. | Potato-Boro-T.Aman | Syedpur |
| 9. | Potato-T.Aus-T.Aman | Chandina |
| 10. | Onion-T.Aus-T.Aman | Kushtia |
| 11. | T.Aus-T.Aman | Golapganj, Moulvibazar, Jhalokati |
| 12. | Mungbean-T.Aus-T.Aman | Bhola |
| 13. | Potato-Jute | Munshiganj |
| 14. | Mustard-Boro | Manikganj, Kaliakoir |
| 15. | Chilli - T.Aman | Lebukhali |
| 16. | Sesame - T.Aman | Dumuria |

**Fertilizer dose (Kg/ha) of different cropping patterns tested in different locations**

Site: Narikeli, Jamalpur

| Treatment | Potato (N-P-K-S-Zn-MOC) | Jute (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 110-20-75-10-2-0 | 80-6-40-2 | 80-7-40-8 |
| $T_2$ | 150-30-125-15-3-0 | 120-8-60-3 | 100-8-50-12 |
| $T_3$ | 130-20-100-15-3-500 | 120-8-60-3 | 100-8-50-12 |
| $T_4$ | 90-15-50-10-1-0 | 40-7-20-3 | 60-8-30-4 |
| $T_5$ | 120-20-80-0-0-0 | 30-5-30-0 | 60-12-30-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Melandah, Jamalpur

| Treatment | Mustard (N-P-K-S-Zn-B-MOC) | Boro (N-P-K-S-Zn-MOC) | T.Aman (N-P-K-S-MOC) |
|---|---|---|---|
| $T_1$ | 81-6-23-14-4-1-0 | 143-7-46-10-4-0 | 100-4-46-14-0 |
| $T_2$ | 53-5-19-14-4-1-500 | 117-3-42- 10-4-500 | 49-20-42-10-0 |
| $T_3$ | 58-4-16-10-3-1-0 | 102-5-33-7-3-0 | 61-4-25-4-0 |
| $T_4$ | 87-13-15-14-0 | 144-38-49-11-8-0 | 115-14-22-11-0 |
| $T_5$ | 0-0-0-0-0-0-0 | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Sherpur, Jamalpur

| Treatment | Wheat (N-P-K-S-Zn-MOC) | Jute (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 100-20-50-17-1-0 | 80-15-50-10 | 70-10-40-7 |
| $T_2$ | 125-30-75-27-1.5-0 | 120-20-80-20 | 100-15-50-10 |
| $T_3$ | 75-10-50-27-1.5-500 | 90-10-70-20 | 75-7-44-10 |
| $T_4$ | 80-17-40-12-1.0-0 | 30-4-15-20 | 70-8-25-4 |
| $T_5$ | 30-22-28-0-0-0 | 30-25-31-12 | 58-3-31-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Muktagacha, Mymensingh

| Treatment | Mustard (N-P-K-S) | Boro rice (N-P-K-S) | T.Aman rice (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 47-21-34-2 | 70-12-14-4 | 47-8-7-3 |
| $T_2$ | 65-27-49-2.3 | 96-18-19-5 | 64-10-52-3.8 |
| $T_3$ | 59-25-44-20 + CD @ 5t/ha | 86-14-10-5 | 64-10-52-3.8 |
| $T_4$ | 55-10-20-10 | 100-9-30-5 | 60-8-30-4 |
| $T_5$ | 50-35-40-3 | 120-14-23-11 | 84-15-20-7 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Gabtali, Bogra

| Treatment | Mustard (N-P-K-S-Zn-B-Oilcake) | Boro rice | T.Aman rice |
|---|---|---|---|
| $T_1$ | 65-28-29-14-1-0.5-0 | 94-20-47-11-1.3-0 | 65-15-33-7-1-0 |
| $T_2$ | 88-37-42-17-1.5-0.5-0 | 132-29-66-16-2-0 | 88-17-42-9-1.5-0 |
| $T_3$ | 68-30-37-17-1.5-0.5-400 | 112-22-61-16-2-0-400 | 68-10-37-9-1.5-0-400 |
| $T_4$ | 65-15-30-15-1-1-0 | 100-15-40-10-1-0 | 65-5-30-3-0 |
| $T_5$ | 52-15-27-14--0-0 | 69-12-26-7-0-0 | 52-10-26-0-0 |
| $T_6$ | 0-0-0-0-0-0-0 | 0-0-0-0-0-0 | 0-0-0-0-0-0-0 |

Site: Joypurhat, Bogra

| Treatments | Boro (N-P-K-S-Zn) | T.Aman (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 97-25-60-17-105-0 | 67-11-42-6-0 |
| $T_2$ | 136-35-83-23-2.0 | 91-14-54-8-0 |
| $T_3$ | 121-30-68-23-2.0-CD 5 t/ha | 76-9-44-8-0- CD 5 t/ha |
| $T_4$ | 110-25-65-15-1 | 75-12-40-5-0 |
| $T_5$ | 87-26-40-3-1.0 | 71-10-23-0-0 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 |

Site: Bagherpara, Jessore

| Treatment | Mustard (N-P-K-S-Zn) | Boro (N-P-K-S-Zn) | T.Aman (N-P-K-S-Zn) |
|---|---|---|---|
| $T_1$ | 61-11-6-24-0 | 90-5-0-9-0 | 61-4-0-7-0 |
| $T_2$ | 86-15-11-30-0 | 125-7-0-12-0 | 83-5-0-9-0 |
| $T_3$ | 81-12-6-30-0 + 5 t/ha CD | 125-7-0-12-0 | 83-5-0-9-0 |
| $T_4$ | 61-11-6-24-0 | 100-20-35-10-2 | 70-6-20-40-0 |
| $T_5$ | 86-30-16-6-0 | 135-57-45-17-4 | 135-57-45-17-4 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 | 0-0-0-0-0 |

Site: Kishoregonj

| Treatments | Wheat (N-P-K-S) | Jute (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 71-28-10-8 | 73-18-10-10 | 64-17-17-4 |
| $T_2$ | 101-38-15-12 | 103-25-14-14 | 87-20-22-5 |
| $T_3$ | 91-32-7-12+CD.5 t/ha | 103-25-14-14 | 87-20-22-5 |
| $T_4$ | 50-10-25-7 | 30-4-15-0 | 35-4-15-3 |
| $T_5$ | 42-8-5-0 | 23-0-0-0 | 64-10-13-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Goyeshpur, Pabna

| Treatment | Wheat (N-P-K-S-Zn-B-CD) | Jute (N-P-K-S) | T.Aman (N-P-K-S-Zn) |
|---|---|---|---|
| $T_1$ | 75-26-17-20-2.5-0.3 | 71-8-8-8 | 60-8-2-5 |
| $T_2$ | 107-35-24-29-3.5-0.5 | 94-11-11-11 | 80-9-3-7 |
| $T_3$ | 82-26-19-29-3.5-0.5+5000 | 94-11-11-11 | 80-9-3-7 |
| $T_4$ | 90-20-35-10-2-0.5 | 65-7-20-4 | 70-8-20-4 |
| $T_5$ | 64-26-17-0-0-0 | 35-11-25-1.36 | 75-16-29-4-6 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Kendua, Kishoreganj

| Treatments | Boro (N-P-K-S-Zn) | T.Aman (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 75-26-48-10-0.6 | 46-18-34-7-0.5 |
| $T_2$ | 105-37-69-15-1.08 | 70-22-43-9-0.83 |
| $T_3$ | 97-35-35-15-1.08 + 4 t/ha straw residue | 62-20-11-9-0.83 |
| $T_4$ | 100-15-40-10-1 | 60-8-30-4-0 |
| $T_5$ | 105-24-37-13-0 | 58-14-25-0-0 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 |

Site: Phulpur, Mymensingh

| Treatment | Boro rice (N-P-K-S-Zn) | T.Aman rice (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 100-10.5-40-13.5-1.0 | 67-4.5-28-4-0 |
| $T_2$ | 140-14.7-55-19-1.3 | 94-5.5-36-5.5-0 |
| $T_3$ | 130-9.7-46-19-1.3 | 94-5.5-36-5.5-0 |
| $T_4$ | 100-15-40-10-1.0 | 60-8-30-4-0 |
| $T_5$ | 108-20.4-26-4.9-0 | 84-15-20-7-0 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 |

Site: Netrakona, Mymensingh

| Treatment | Boro rice (N-P-K-S-Zn) | T.Aman rice (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 95-29.5-37.6-12.2-0 | 65.5-9.7-27-3.7-0 |
| $T_2$ | 134-42.2-52.6-17.1-0 | 89.3-11.6-35-4.9-0 |
| $T_3$ | 124-36.2-42.6-17.1-0 | 89.3-11.6-35-4.9-0 |
| $T_4$ | 100-15.0-40.0-10.0-1.0 | 60-8-30-4-0 |
| $T_5$ | 120-18-20-5-0 | 92-16-23-8-0 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 |

Site: Shibpur, Narsinghdi

| Treatment | Boro (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 83-21-40-3 | 57-9-25-2 |
| $T_2$ | 116-30-55-5 | 78-12-32-3 |
| $T_3$ | 106-25-45-5+CD 10t/ha | 78-12-32-3 |
| $T_4$ | 100-15-40-10 | 60-8-30-4 |
| $T_5$ | 100-30-60-4 | 80-16-20-2 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

Site: Ishan Gopalpur, Faridpur

| Treatment | Boro (N-P-K-S-Zn-CD) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 64-18-25-10-1.5-0 | 44-9-4-3 |
| $T_2$ | 90-25-30-14-2-0 | 60-10-4.5-4 |
| $T_3$ | 75-20-15-40-2-5 t/ha | 60-10-4.5-4 |
| $T_4$ | 90-20-25-10-1.5-0 | 60-4-12-2 |
| $T_5$ | 100-29-37-12-4-0 | 85-30-20-20 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 |

Site: Sujanagar, Pabna

| Treatment | Boro (N-P-K-S-Zn-B-CD) | T.Aman |
|---|---|---|
| $T_1$ | 94-27-20-16-0.29-1.0-0 | 64-13-15-5-0.2-1 |
| $T_2$ | 133-38-20-22-0.38-1.0-0 | 87-16-15-7-0.3-1 |
| $T_3$ | 108-18-3-22-0.38-+5000 | 87-16-15-7-0.3-1 |
| $T_4$ | 100-20-35-10-1.5-0 | 70-8-20-4-0 |
| $T_5$ | 93-29-35-0-0-0 | 113-21-29-15-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Feni, Noakhali

| Treatment | Boro (N-P-K-S-Zn-B-CD) | T.Aman |
|---|---|---|
| $T_1$ | 130-33-86-20-1.5-0 | 90-12-60-12-1 |
| $T_2$ | 183-47-120-28-2-0 | 122-14-77-16-1.5 |
| $T_3$ | 168-42-105-28-2-0 + CD 5t/ha | 122-14-77-16-1.5 |
| $T_4$ | 95-20-40-10-1 | 65-7-25-4-0 |
| $T_5$ | 85-20-60-0 | 76-16-30-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Satkaniya, Chittagong

| Treatment | Boro (N-P-K-S-Zn-B-CD) | T.Aman |
|---|---|---|
| $T_1$ | 89-20-54-16-0-0 | 61-7-38-4 |
| $T_2$ | 126-28-75-23-0 | 84-9-48-7 |
| $T_3$ | 116-22-65-23-0 + CD 10 t/ha | 84-9-48-7 |
| $T_4$ | 100-10-40-5-0 | 70-4-35-1 |
| $T_5$ | 86-25-16-0 | 75-26-17-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Golapganj, Sylhet

| Treatment | T.Aus (N-P-K-S-Zn-B-CD) | T.Aman |
|---|---|---|
| $T_1$ | 68-17-41-4.8-0 | 68-9-41-2.4-0 |
| $T_2$ | 93-21-53-6.4-0 | 93-11-53-3.2-0 |
| $T_3$ | 78-16-38-6.4-0+CD (5 t/ha) | 93-11-53-3.2-0 |
| $T_4$ | 40-8-20-4-1 | 40-4-20-2-0 |
| $T_5$ | 54-12-22-0-0 | 54-12-22-0-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Moulvibajar, Sylhet

| Treatment | T.Aus (N-P-K-S-Zn-B-CD) | T.Aman |
|---|---|---|
| $T_1$ | 66-14-32-3.6-0 | 66-7-32-1.8-0 |
| $T_2$ | 90-16-41-4.8-0 | 90-8-41-2.4-0 |
| $T_3$ | 75-11-26-4.8-0+CD (5 t/ha) | 90-8-41-2.4-0 |
| $T_4$ | 40-8-20-4-1 | 40-4-20-2-0 |
| $T_5$ | 64-10-17-0-0 | 64-10-17-0-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0-0 |

Site: Kalaroa, Khulna

| Treatment | Boro (N-P-K-S-Zn) | T.Aman (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 100-23-22-13-20 | 68-10-15-8 |
| $T_2$ | 140-33-30-18-2.5 | 92-13-20-11 |
| $T_3$ | 130-27-20-18-2.5+10 t/ha CD | 92-13-20-11 |
| $T_4$ | 100-20-35-10-1.5 | 70-6-20-4 |
| $T_5$ | 138-30-37-0-2.7 | 135-30-37.5-0-5.4 |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0-0 |

Site:Dumuria, Khulna

| Treatment | Sesame (N-P-K-S-Zn) | T.Aman (N-P-K-S-Zn) |
|---|---|---|
| $T_1$ | 50-20-14-15-1 | 35-4-15-2 |
| $T_2$ | 65-26-18-20-1.5 | 45-5-20-3 |
| $T_3$ | 50-21-3-20-1.5 + CD 5 t/ha | 45-5-20-3 |
| $T_4$ | 50-20-14-15-1 | 35-4-15-2 |
| $T_5$ | 0-0-0-0-0 | 0-0-0-0 |

Site: Laxmipur, Noakhali

| Treatment | Groundnut (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 20-30-10-0 | 60-12-14 |
| $T_2$ | 30-40-15-0 | 80-15-23 |
| $T_3$ | 18-35-10-0+ CD 5 t/ha | 80-15-16 |
| $T_4$ | 20-20-25-12 | 65-7-25-4 |
| $T_5$ | 6-24-0-0 | 36-6-0-0 |
| $T_6$ | 0 | 0 |

Site:Atkapalia, Noakhali

| Treatment | Groundnut (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 21-33-24-0-0 | 66-12-22-0-1 |
| $T_2$ | 30-43-34-0-0 | 90-14-29-0-1.5 |
| $T_3$ | 15-38-19-0-0 + CD 5 t/ha | 90-14-29-0-1.5 |
| $T_4$ | 20-20-25-12-1 | 65-7-25-4-0 |
| $T_5$ | 6-24-0-0-0 | 38-16-0-0 + CD 1.25 t/ha |
| $T_6$ | 0-0-0-0-0 | 0-0-0-0 |

Site: Barind, Rajshahi

| Treatments | Potato (N-P-K-S-Zn-B) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 106-22-37-8-2.5-0.8 | 74-9-16-6 |
| $T_2$ | 147-32-54-18-4-1.0 | 100-11-20-8 |
| $T_3$ | 138-27-48-18-4-1.0 + Cd 10 t/ha | 100-11-20-8 |
| $T_4$ | 161-30-132-18-2.5-1.0 | 75-12-40-5 |
| $T_5$ | 207-70-210-18-2-1.0 | 62-13-16-8 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 |

Site: Paba, Rajshahi

| Treatments | Potato (N-P-K-S-Zn-B) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 88-34-48-0-0-0 | 62-0-10-0 |
| $T_2$ | 124-45-66-0-0-0 | 85-0-15-0 |
| $T_3$ | 94-22-30-0-0 + CD 10 t/ha | 85-0-15-0 |
| $T_4$ | 98-45-48-0 | 70-6-20-4 |
| $T_5$ | 170-255-225-21-6-4 | 62-25-15-8 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 |

Site: Natore, Rajshahi

| Treatments | Groundnut (N-P-K-S-Zn-B) | T.Aman (N-P-K-S) |
|---|---|---|
| $T_1$ | 21-24-20-8-1.5-0 | 62-7-16-3 |
| $T_2$ | 30-30-29-10-2.5-0 | 85-9-20-4 |
| $T_3$ | 15-25-14-10-2.5 -0+ CD 5 t/ha | 85-9-20-4 |
| $T_4$ | 21-24-20-8-0-0 | 70-6-20-4 |
| $T_5$ | 6-17-21-2-0-0 | 97-47-32-0 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 |

Site: Syedpur, Rangpur

| Treatment | Potato (N-P-K-S-Mg-Zn-B-CD) | Boro (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 95-17-98-12-10-2-1-0 | 95-7-51-8 | 65-5-36-5 |
| $T_2$ | 135-25-140-17-15-3-1.5-0 | 135-10-71-11- | 90-7-46-7 |
| $T_3$ | 105-15-110-17-15-3-1.5-10000 | 135-10-71-11 | 90-7-46-7 |
| $T_4$ | 100-20-50-8-0-1-0-0 | 100-10-20-5 | 65-7-20-3 |
| $T_5$ | 110-48-160-20-0-4-1-7500 | 69-0-0-0 | 97-18-28-0 |
| $T_6$ | 0-0-0-0-0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Chandina, Comilla

| Treatment | Potato (N-P-K-S-Zn) | T.Aus (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 80-11-50-113-4 | 51-10-55-8 | 51-10-55-8 |
| $T_2$ | 113-20-101-15-5 | 72-12-60-12 | 72-12-60-12 |
| $T_3$ | 88-12-75-15-5 (5t/ha CD) | 44-10-40-12 (5t/ha) | 44-10-40-12 (5t/ha) |
| $T_4$ | 95-20-56-8-3 | 64-14-40-8 | 64-14-40-8 |
| $T_5$ | 225-117-225 | 90-59-100 | 90-59-100 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Kushtia

| Treatment | Onion (N-P-K-S-Zn-CD) | T.Aus (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 80-60-0-0-2-0 | 55-15-7-3 | 55-15-7-3 |
| $T_2$ | 80-60-0-0-2-0 | 75-18-10-5 | 75-18-10-5 |
| $T_3$ | 70-55-0-0 -2-10t/ha | 75-18-10-5 | 75-18-10-5 |
| $T_4$ | 100-40-60-25-2-0 | 70-6-15-4 | 70-6-15-4 |
| $T_5$ | 109-22-74-17-0-0 | 52-25-31-4 | 52-25-31-4 |
| $T_6$ | 0-0-0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

Site: Jhalokati, Barisal

| Treatment | T.Aus (N-P-K-Zn) | T.Aman (N-P-K-Zn) |
|---|---|---|
| $T_1$ | 60-15-0-0.5 | 66-5-0-0 |
| $T_2$ | 80-16-0-1 | 96-7.5-0-0 |
| $T_3$* | 70-6-0-1 | 96-7.5-0-0 |
| $T_4$ | 50-5-35-2 | 44-7.5-35-0 |
| $T_5$ | 40-8-0-0 | 40-8-0-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

*2 t/ha CD were applied in $T_3$ treatment

Site: Bhola, Barisal

| Treatment | Mungbean (N-P-K-S) | T.Aus (N-P-K-S) | T.Aman (N-P-K-S) |
|---|---|---|---|
| $T_1$ | 20-10-01 | 64-5-0-1.5 | 66-5-0-1.5 |
| $T_2$ | 25-15-0-2 | 64-7.5-0-2 | 96-7.5-0-2 |
| $T_3$* | 5-5-0-2 | 94-7.5-0-2 | 96-7.5-0-2 |
| $T_4$ | 12-8-8-6 | 44-7.5-0-5 | 46-7.5-0-5 |
| $T_5$ | 0-0-0-0 | 40-8-35-0 | 36-8-35-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 | 0-0-0-0 |

*2 t/ha CD were applied in $T_3$ treatment

Site: Lebukhali, Patuakhali

| Treatment | Chilli (N-P-K-S) | T.Aman (N-P-K) |
|---|---|---|
| $T_1$ | 95-81-76 | 46-15-25 |
| $T_2$ | 123-105-98 | 65-19-35 |
| $T_3$ | 93-95-68 + CD 10 t/ha | 65-19-35 |
| $T_4$ | 65-40-50 | 30-3-15 |
| $T_5$ | 60-25-0 | 60-0-0 |
| $T_6$ | 0-0-0 | 0-0-0 |

Site: Munshiganj

| Treatment | Potato (N-P-K-S) | Jute (N-P-K-S) |
|---|---|---|
| $T_1$ | 90-8-35-10 | 35-0-10-0 |
| $T_2$ | 128-11-50-15 | 50-0-15-0 |
| $T_3$ | 118-6-40-15+ CD 10 t/ha | 50-0-15-0 |
| $T_4$ | 95-20-56-8 | 35-4-20-3 |
| $T_5$ | 400-150-400-0 | 60-0-0-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

Site: Manikganj

| Treatment | Mustard (N-P-K-S-Zn-B-CD) | Boro (N-P-K-S-Zn-CD) |
|---|---|---|
| $T_1$ | 66-25-21-18-2-1 | 96-15-38-6 |
| $T_2$ | 93-32-31-23-3-1 | 135-21-54-8 |
| $T_3$ | 78-27-16-23-3-1 + CD 5 t/ha | 135-21-54-8 |
| $T_4$ | 60-15-10-10-0-0 | 100-15-35-6 |
| $T_5$ | 105-24-45-5-0-0 | 104-27-28-25-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

Site: Kaliakoir

| Treatment | Mustard (N-P-K-S-Zn-B-CD) | Boro (N-P-K-S-Zn-CD) |
|---|---|---|
| $T_1$ | 67-22-25-16-1-0.5 | 98-13-45-5-1 |
| $T_2$ | 99-28-36-19-2-0.5 | 138-19-63-7-1.5 |
| $T_3$ | 84-23-21-19-2-0.5 + CD 5 t/ha | 138-19-63-7-1.5 |
| $T_4$ | 60-15-10-10-0-0-0 | 100-15-35-6-1 |
| $T_5$ | 138-38-39-0-0-0 | 115-35-26-7-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

## Results and Discussion

**CP : Mustard-Boro-T.Aman**
**Location : Melandah, Jamalpur (AEZ 9)**
**Year : 1999-2000 to 2001-02**

Average of three years data revealed that higher grain yield of Mustard was obtained from $T_2$ followed by $T_1$ and $T_3$. However, during 2000-01 grain yield was not differed significantly among the treatments except with control. Soil test based fertilizer dose for HYG ($T_1$) and fertilizer dose from FRG '97 produced almost similar yield. Similarly, in Boro rice grain yield was higher in $T_2$ and closely followed by $T_1$ and $T_3$. During 2000-01 there was no significant difference in yield was found except control. But in 2001-02 the yield was only differed with Farmers' practice ant control treatment. In T.Aman rice, no significant difference in yield was found among the treatments except with Farmers' practice and control treatments. However, during 2000-01 and 2001-02 the yield was significantly higher in $T_1$ but in 1999-2000 treatment $T_2$ produced significantly higher yield. In straw/stover yield more or less similar trend was found.

On an average, cost and return analysis showed that the highest gross margin was obtained from IPNS ($T_2$) treatment closely followed by $T_1$. But the highest MBCR was calculated from $T_3$ followed by $T_1$. In IPNS treatment reduced the MBCR, due to additional cost of MOC. Based on three years of experimentation the present fertilizer recommendation FRG '97 was found superior in respect of yield and profit.

Table 1. Yield of Mustard, Boro and T.Aman as affected by fertilizer levels in the cropping pattern Mustard-Boro-T.Aman at Melandah, Jamalpur during 1999-2000 to 2001-02

| Treat | Seed/grain yield (t/ha) | | | Seed/grain yield (t/ha) | | | Seed/grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001-02 | | | 2000-01 | | | 1999-2000 | | |
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 0.82b | 6.50a | 5.45a | 1.05a | 6.48a | 4.93a | 0.71b | 3.76c | 3.94b |
| $T_2$ | 1.04a | 6.07a | 4.97b | 1.11a | 6.04a | 4.08b | 1.06a | 5.92a | 4.33a |
| $T_3$ | 0.76b | 6.06a | 4.58b | 0.99a | 5.88a | 4.40ab | 0.75b | 4.21b | 3.78b |
| $T_4$ | 0.75b | 5.01b | 3.62c | 0.82a | 5.80a | 4.27b | 0.57c | 3.61c | 3.51c |
| $T_5$ | 0.45c | 2.13c | 2.04d | 0.43b | 2.08b | 3.45c | 0.27d | 1.52d | 1.09d |

Table 1. Contd.

| Treat | Stover/ Straw yield (t/ha) | | | Stover/ Straw yield (t/ha) | | | Stover/ Straw yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001-02 | | | 2000-2001 | | | 1999-2000 | | |
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 2.31b | 6.67a | 5.83a | 4.55a | 6.80a | 6.73a | 1.79b | 4.66bc | 4.43c |
| $T_2$ | 2.91a | 5.84b | 5.46a | 4.68a | 6.61ab | 6.06b | 2.07a | 6.31a | 5.26a |
| $T_3$ | 2.26b | 5.97b | 5.69a | 4.43a | 5.29b | 5.75b | 1.79b | 4.87b | 4.71b |
| $T_4$ | 2.21b | 6.28ab | 5.60a | 3.41b | 4.96b | 5.90b | 1.76b | 3.74c | 4.81b |
| $T_5$ | 1.25c | 2.55c | 2.07b | 1.29c | 2.30c | 4.84c | 1.02c | 1.29d | 1.24d |

Figure in the column having similar letter(s) do not differ significantly

Table 2. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as affected by fertilizer levels at Melandaha, Jamalpur during 1999-2000 to 2001-02

| Treat | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR | TVC | GM | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | | | | |
| $T_1$ | 0.86 | 5.58 | 4.77 | 2.05 | 6.04 | 5.66 | 96175 | 9717 | 86458 | 5.87 |
| $T_2$ | 1.07 | 6.01 | 4.46 | 2.49 | 6.25 | 5.59 | 100710 | 13686 | 87024 | 4.50 |
| $T_3$ | 0.83 | 5.38 | 4.25 | 2.02 | 5.38 | 5.38 | 89950 | 6819 | 83131 | 7.45 |
| $T_4$ | 0.71 | 4.81 | 3.80 | 1.98 | 4.99 | 5.44 | 80722 | 10650 | 70072 | 3.90 |
| $T_5$ | 0.38 | 1.91 | 2.19 | 1.13 | 2.05 | 2.72 | 39107 | 0 | 39107 | - |

**Output (kg/tk.):** Mustard 15.00, T.Aman rice = 7.00, Boro = 7.00, Mustard straw = 1.00, Rice straw = 0.75

**Inputs (kg/tk.):** Urea = 5.60, TSP = 12.40, MP = 9.40, Gypsum = 4.00, Zinc sulphate = 25.00, Mustard oil cake = 6.00, Boric acid = 90.00

**CP : Potato-Jute-T.Aman**
**Location : Narikeli, Jamalpur (AEZ 9)**
**Year : 2001-02**

## Crop yield

Tuber yield of Potato did not vary significantly among the treatments except with no fertilizer treatment. Effect of higher levels of fertilizers as well as organic manure on the yield of Potato was not evident. Almost similar result was observed in fibre yield of Jute and the yield is only differed with Farmers practice and control plots. In T.Aman rice significantly higher grain yield was recorded from STB fertilizer dose for HYG ($T_2$) and IPNS treatment ($T_3$). Fertilizer dose for MYG (STB & FRG '97) produced identical yield with Farmers practice. In all cases the lowest yield was obtained from no fertilizer ($T_5$). Almost similar trend was observed in stick yield of Jute. But in straw yield of T.Aman rice no significant difference was found among the different nutrient packages except with no fertilizer treatment.

From cost and return analysis showed that the highest gross margin was obtained from $T_1$ closely followed by $T_3$ but higher MBCR was recorded from treatment $T_4$ followed by $T_1$. It is noted that MBCR was lowest in IPNS treatment due to the additional cost of MOC.

Table 3. Yield, cost and return analysis of Potato-Jute-T.Aman cropping pattern as affected by different fertilizer packages at Narikeli, Jamalpur during 2001-2002

| Treat. | Grain yield (t/ha) | | | Stover/stick/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Potato | Jute | T.Aman | Potato | Jute | T.Aman | | | | |
| $T_1$ | 31.0a | 2.5a | 4.2b | - | 3.7a | 4.4a | 180400 | 9653 | 170747 | 7.25 |
| $T_2$ | 29.0a | 2.4a | 4.5a | - | 3.6a | 4.4a | 173600 | 11846 | 161754 | 5.34 |
| $T_3$ | 32.0a | 2.5a | 4.5a | - | 3.6a | 4.5a | 185475 | 17354 | 169121 | 4.33 |
| $T_4$ | 28.0a | 2.2a | 4.2b | - | 3.5ab | 4.6a | 165950 | 7069 | 158881 | 7.86 |
| $T_5$ | 27.0a | 2.0b | 3.8b | - | 3.3b | 4.5a | 157275 | 7891 | 149384 | 5.94 |
| $T_6$ | 20.0b | 1.1c | 2.5c | - | 2.3c | 2.3b | 110325 | 0 | 110325 | - |

**Output (kg/tk.):** Potato Tk. 4.00, T.Aman rice = Tk. 7.00, Jute (fiber) =Tk. 7.00, Jute stick = Tk. 1.00, Rice straw = Tk. 0.75

**Inputs (kg/tk.):** Urea= Tk. 6.00, TSP = Tk. 14.00, MP =Tk. 10.00, Gypsum =Tk. 3.00, Zinc sulphate =Tk. 25.00, Mustard oil cake =Tk. 10.00

**CP : Wheat-Jute-T.Aman**
**Location : Sherpur, Jamalpur (AEZ 9)**
**Year : 2001-02**

### Crop yield

Grain yield of Wheat did not vary significantly among the treatments except with FRG '97 ($T_4$) and no fertilizer treatment ($T_6$). However, STB fertilizer doses for HYG & MYG ($T_2$ & $T_1$) also produced identical yield with FRG '97. In Jute, the highest fibre yield was recorded from IPNS ($T_3$) which is also identical to $T_2$ and $T_1$. Fertilizer doses for MYG (STB & FRG '97 produced similar yield along with farmers' practice ($T_5$). In T.Aman rice almost similar trend was found in grain yield. In all cases the lowest yield was obtained from no fertilizer ($T_6$). More or less the trend was similar in case of straw/stick yield of Wheat, T.Aman rice and Jute, respectively.

From Cost and return analysis it was found that the highest gross margin was calculated from STB fertilizer dose ($T_1$) closely followed by $T_2$ and $T_5$. Regarding MBCR the highest value was obtained from $T_4$ (FRG '97). Due to higher fertilization cost the MBCR was lower in $T_2$ and $T_3$.

Table 4. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as affected by different fertilizer packages at Sherpur, Jamalpur during 2001-02

| Treat. | Grain yield (t/ha) | | | Stover/stick/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | | | | |
| $T_1$ | 2.37ab | 1.79ab | 4.39ab | 3.87ab | 4.42a | 5.28a | 78460 | 8378 | 70082 | 5.42 |
| $T_2$ | 2.39ab | 1.98a | 4.47a | 3.89ab | 4.60a | 5.53a | 81299 | 12096 | 69203 | 3.99 |
| $T_3$ | 2.53a | 2.01a | 4.31ab | 4.21a | 4.67a | 5.39a | 81623 | 13616 | 68007 | 3.57 |
| $T_4$ | 2.05b | 1.67b | 4.05c | 3.61b | 4.47a | 4.87b | 71883 | 5459 | 66424 | 7.12 |
| $T_5$ | 2.43a | 1.75b | 4.16bc | 3.88ab | 4.37a | 4.96b | 76547 | 8500 | 68047 | 5.12 |
| $T_6$ | 0.83c | 1.01c | 1.81d | 1.63c | 1.67b | 2.91c | 33008 | 0 | 33008 | - |

**Output (kg/Tk):** Wheat Tk. 7.00, T.Aman rice = Tk. 7.00, Jute (fiber) =Tk. 6.25, Jute stick = Tk. 0.75, Rice straw = Tk. 0.75, Wheat straw = Tk. 0.50

**Inputs (kg/Tk):** Urea= Tk. 5.60, TSP = Tk. 12.40, MP =Tk. 9.40, Gypsum =Tk. 4.00, Zinc sulphate =Tk. 25.00, Mustard oil cake =Tk. 10.00

**CP : Mustard-Boro-T.Aman**
**Location: Muktagacha, Mymensingh (AEZ 9)**
**Year : 2001-02**

Average of three years data showed that seed yield of Mustard did not differ significantly among the different fertilizer packages except with $T_1$ and no fertilizer ($T_6$). However the higher yield was recorded from $T_3$ where IPNS based fertilizer was applied. During 1999-2000 and 2000-01 yield was drastically reduced due to late sowing of Mustard. In Boro rice, higher grain yield was recorded from $T_3$, followed by $T_4$, $T_2$ and $T_5$. However, the trend was slightly varied over the years. The highest yield was obtained from IPNS ($T_3$) but it was identical to $T_2$, $T_4$ and $T_5$. Similarly in T.Aman rice, higher yield was obtained from $T_3$ but it was almost identical to $T_2$ and Farmers' practice. Regarding stover/straw yield almost similar trend was found. Initial nutrient status of the soil showed that the soil of the experimental plot was deficit in NPK but the response of crops to higher doses of nutrients was not apparent. The status of micronutrients like Zn and B was not known and not applied in the soil at all. That might be one of the reasons for low response of nutrients towards yield.

On an average, cost and return analysis showed that the highest gross margin was obtained from $T_3$ (IPNS) higher MBCR was found where IPNS based fertilizer dose was used. Considering the agro-economic performance and long term soil fertility, IPNS based fertilizer dose could be suggested for the cropping pattern at Muktagacha, Mymensingh.

Table 5. Yield of Mustard, Boro and T.Aman as affected by fertilizer levels in the cropping pattern Mustard-Boro-T.Aman at Muktagacha, Mymensingh during 1999-2000 to 2001-02

| Treat | Seed/grain yield (t/ha) 2001-02 | | | Seed/grain yield (t/ha) 2000-2001 | | | Seed/grain yield (t/ha) 1999-2000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 0.673b | 3.86c | 2.40d | 468.3b | 4.51b | 3.46c | 397.0a | 3.94c | 3.84c |
| $T_2$ | 0.980a | 4.93b | 2.79ab | 543.3ab | 5.36a | 4.41a | 460.0a | 4.13bc | 4.84a |
| $T_3$ | 0.967a | 5.32a | 3.17a | 601.7a | 5.44a | 4.52a | 447.0a | 4.63a | 4.95a |
| $T_4$ | 0.993a | 5.23a | 3.24a | 530.0ab | 5.23a | 3.90b | 462.0a | 4.38ab | 4.33b |
| $T_5$ | 0.960a | 5.20a | 3.11a | 501.7ab | 4.49b | 4.40a | 415.0a | 4.52a | 4.93a |
| $T_6$ | 0.393c | 3.18 | 2.36b | 246.2c | 3.44c | 2.73d | 205.0b | 3.34d | 3.08d |

Table 5. Contd.

| Treat | Stover/ Straw yield (t/ha) 2001-02 | | | Stover/ Straw yield (t/ha) 2000-2001 | | | Stover/ Straw yield (t/ha) 1999-2000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 1.11c | 4.83c | 4.36c | 0.73ab | 5.61c | 4.12c | 0.51b | 4.94a | 4.52b |
| $T_2$ | 1.64ab | 5.98b | 4.70b | 0.72b | 6.18ab | 5.01ab | 0.59a | 4.98a | 5.53a |
| $T_3$ | 1.72a | 6.20ab | 4.96ab | 0.80a | 6.34a | 5.10a | 0.59a | 5.33a | 5.63a |
| $T_4$ | 1.74a | 6.10b | 5.00ab | 0.73ab | 5.93bc | 4.76b | 0.61a | 5.03a | 5.33a |
| $T_5$ | 1.58b | 6.36a | 5.24a | 0.77ab | 5.69c | 5.06a | 0.55ab | 5.40a | 5.62a |
| $T_6$ | 0.89d | 4.17d | 3.93d | 0.46c | 4.75d | 3.24d | 0.35c | 3.82b | 3.67c |

Figure in the column having similar letter(s) do not differ significantly

Table 6. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as affected by fertilizer levels at Muktagacha, Mymensingh during 1999-2000 to 2001-02 (Avg.of 3 years)

| Treat | Grain yield (t/ha) | | | Stover/straw yield (t/ha) | | | GR | VC | GM | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | | | | |
| $T_1$ | 0.512 | 4.10 | 3.23 | 0.783 | 5.12 | 4.33 | 65528 | 7559 | 57969 | 1.79 |
| $T_2$ | 0.661 | 4.81 | 4.01 | 0.983 | 5.71 | 5.01 | 79208 | 11041 | 68165 | 2.51 |
| $T_3$ | 0.672 | 5.13 | 4.21 | 1.037 | 5.96 | 5.23 | 83447 | 12705 | 70742 | 2.47 |
| $T_4$ | 0.662 | 4.95 | 3.82 | 1.027 | 5.69 | 5.03 | 79082 | 8247 | 70835 | 3.77 |
| $T_5$ | 0.625 | 4.74 | 4.15 | 0.967 | 5.82 | 5.31 | 79412 | 11413 | 48345 | 2.44 |
| $T_6$ | 0.281 | 3.32 | 2.72 | 0.567 | 4.25 | 3.61 | 51992 | 0 | 51992 | - |

**Output:** Mustard Tk. 15.00, T.Aman rice = Tk. 7.00, Boro =Tk. 7.00, Mustard straw = Tk. 0.50, Rice straw = Tk. 0.50

**Inputs:** Urea = Tk. 6.00, TSP = Tk. 14.00, MP =Tk. 10.00, Gypsum =Tk. 4.00, Cowdung =Tk. 0.50

**CP : Mustard-Boro-T.Aman**
**Location : Gabtali, Bogra (AEZ 25)**
**Year : 2001-02**

Significantly higher seed yield of Mustard was recorded from $T_2$. No considerable response of MOC applied in IPNS treatment was evident in the yield of Mustard. Similarly, in Boro and T.Aman rice the highest yield was recorded from the same treatment. Like Mustard no response of MOC was observed in grain yield of rice. Fertilizer doses for MYG (STB & FRG '97) produced similar yield in all the crops of the pattern. In stover yield of Mustard significantly higher yield was recorded from $T_1$ and $T_3$ and the trend was almost same in T.Aman rice. But in Boro rice no significant difference in straw yield was observed among the different treatments except with Farmers' practice and no fertilizer.

Cost and return analysis showed that highest gross return as well as gross margin was obtained from $T_2$. Regarding MBCR fertilizer dose from FRG '97 gave the highest value closely followed by Farmers' practice. STB fertilizer doses for MYG and HYG also produced similar MBCR. Due to additional cost of MOC the MBCR was the lowest in IPNS treatment ($T_3$) and similarly, due to less fertilization cost in $T_4$ and $T_5$ gave higher MBCR.

Table 7. Yield, cost and return analysis of Mustard -Boro-T.Aman cropping pattern as affected by fertilizer levels at Gabtali, Bogra during 2001-02

| Treat. | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | | | | |
| $T_1$ | 0.96 c | 4.94 c | 3.11 c | 3.04 a | 6.53 ab | 6.09 bc | 73244 | 10894 | 62350 | 3.85 |
| $T_2$ | 1.09 a | 5.93 a | 3.96 a | 2.65 b | 7.05 a | 6.51 a | 87418 | 14783 | 72635 | 3.79 |
| $T_3$ | 1.02 b | 5.27 b | 3.75 b | 3.06 a | 7.14 a | 6.96 ab | 80920 | 26648 | 54272 | 1.86 |
| $T_4$ | 0.90 d | 4.76 c | 3.09 c | 2.73 b | 6.9 a | 6.05 bc | 71074 | 8402 | 62672 | 4.72 |
| $T_5$ | 0.81 e | 3.90 d | 2.72 b | 2.52 b | 6.20 b | 5.91 c | 60908 | 6557 | 54351 | 4.50 |
| $T_6$ | 0.36 f | 1.83 e | 1.72 e | 0.62 c | 3.18 c | 2.96 b | 31344 | 0 | 31344 | - |

**Price:**
Inputs (Tk./kg): Urea = 5.5, TSP = 14.5, MP= 9.5, Gypsum=. 3, Zinc Sulphate = 50,
Products (Tk./kg): T.Aman rice= 6.50, Boro rice = 6.50, Straw = 0.50, Mustard (2001-02) = 14.50

**CP : Mustard-Boro-T.Aman**
**Location : Bagherpara, Jessore (AEZ 11)**
**Year : 2000-01**

Average of three years data showed that the highest seed yield of Mustard was recorded from Farmers' practice ($T_5$) but it did not vary markedly among the fertilizer packages except with no fertilizer treatment. The yield level of mustard was generally low due to late sowing of Mustard and delayed harvest of T.Aman rice. Higher level of fertilizers as well as organic manure failed to produce any significant response towards mustard yield. The trend was more or less similar and the nutrient packages did not vary significantly except with no fertilizer. In Boro rice, higher yield was obtained from Farmers' practice ($T_5$) and FRG '97 ($T_4$). Except control other treatments produced almost similar yield. Yield data over the years showed that during 1999-2000 and 2000-01, significantly higher yield was obtained from $T_5$ and $T_4$ but in 2001-02 there was no variation among the different treatments except with $T_1$ and $T_6$. In T.Aman rice almost similar result was observed. During 1999-2000 and 2001-02 significantly higher yield was recorded from Farmers' practice but in 2000-01 identical yield was found except with $T_6$ and $T_1$. Regarding stover/straw yield more or less similar trend was observed. In farmers' practice the fertilizer dose was much higher and that contributed to the higher yield.

From cost and return analysis it was found that highest gross margin was recorded from $T_4$ (FRG '97) followed by $T_5$ (FP) but the MBCR was higher in $T_2$ and $T_4$. The MBCR was lowest in farmer practice due to application of higher doses of fertilizer. Considering yield and return STB fertilizer dose for HYG could be suggested for the pattern at Jessore region.

Table 8. Yield of Mustard, Boro and T.Aman as affected by fertilizer levels in the cropping pattern Mustard-Boro-T.Aman at Bagherpara, Jessore during 1999-2000 to 2001-02

| Treat | Seed/grain yield (t/ha) 1999-2000 | | | Seed/grain yield (t/ha) 2000-2001 | | | Seed/grain yield (t/ha) 2001-02 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 0.367a | 2.88d | 3.27c | 0.715a | 4.96c | 4.33b | 0.660ab | 4.50b | 3.01b |
| $T_2$ | 0.357a | 3.46c | 3.50c | 0.887a | 5.43b | 4.57ab | 0.790a | 5.85a | 2.91b |
| $T_3$ | 0.322ab | 3.58c | 3.67bc | 0.872a | 5.47b | 5.14ab | 0.613ab | 5.62a | 3.03b |
| $T_4$ | 0.393a | 4.06b | 3.99b | 0.897a | 5.97a | 5.23a | 0.617ab | 5.59a | 3.04b |
| $T_5$ | 0.453a | 4.92a | 4.48a | 0.987a | 5.60ab | 5.10ab | 0.766a | 5.65a | 3.47a |
| $T_6$ | 0.225b | 2.34e | 1.79d | 0.420b | 2.91d | 2.39c | 0.427b | 2.64c | 2.25c |

Table 8. Contd.

| Treat | Stover/ Straw yield (t/ha) 1999-2000 | | | Stover/ Straw yield (t/ha) 2000-2001 | | | Stover/ Straw yield (t/ha) 2001-02 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman |
| $T_1$ | 1.59ab | 3.31b | 3.77c | 2.18b | 5.11c | 4.25a | 1.31ab | 4.31b | 3.33a |
| $T_2$ | 1.46ab | 3.59b | 4.52b | 2.60ab | 5.52abc | 4.59a | 1.31ab | 5.20a | 3.27 |
| $T_3$ | 1.19bc | 3.76b | 4.48b | 2.63ab | 5.69ab | 4.52a | 1.28ab | 5.08a | 3.51a |
| $T_4$ | 1.46ab | 4.29a | 4.68ab | 2.64ab | 5.94a | 4.75a | 1.21ab | 4.77ab | 3.35a |
| $T_5$ | 1.68a | 4.82a | 5.10a | 2.92a | 5.44bc | 5.14a | 1.59a | 5.05a | 3.61a |
| $T_6$ | 0.98c | 2.27c | 2.20d | 1.49c | 3.63d | 2.24b | 0.87b | 2.76c | 2.53b |

Figure in the column having similar letter(s) do not differ significantly

Table 9. Yield, cost and return analysis of Mustard-Boro-T.Aman cropping pattern as affected by fertilizer levels at Bagherpara, Jessore during 1999-02 (Average of 3 years)

| Treat | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | T.Aman | Mustard | Boro | T.Aman | | | | |
| $T_1$ | 0.581 | 4.11 | 3.54 | 1.69 | 4.24 | 3.78 | 65037 | 4293 | 60744 | 5.15 |
| $T_2$ | 0.678 | 4.91 | 3.66 | 1.79 | 4.77 | 4.13 | 77159 | 5744 | 71415 | 5.97 |
| $T_3$ | 0.602 | 4.89 | 3.95 | 1.94 | 4.84 | 4.17 | 77348 | 6722 | 70626 | 5.13 |
| $T_4$ | 0.636 | 5.21 | 4.09 | 1.77 | 5.00 | 4.26 | 81057 | 6618 | 74439 | 5.76 |
| $T_5$ | 0.735 | 5.39 | 4.35 | 2.06 | 5.10 | 4.62 | 86401 | 12717 | 73604 | 3.42 |
| $T_6$ | 0.357 | 2.63 | 2.14 | 1.11 | 2.89 | 2.32 | 42889 | 0 | 42889 | - |

| | | | | |
|---|---|---|---|---|
| Input price: | Urea=Tk. 6.00 /kg | Product price: | Mustard grain - | Tk. 15.50/kg |
| | TSP= Tk. 12.00/kg | | Mustard straw- | Tk. 0.50/kg |
| | MP =Tk. 8.50/kg | | Rice grain | Tk. 7.00/kg |
| | Gypsum= Tk. 3.00/kg | | Rice straw | Tk. 0.75/kg |
| | $ZnSO_4$=Tk. 60.00/kg | | | |

**CP : Wheat-Jute-T.Aman**
**Location : Kishoreganj (AEZ 9)**
**Year : 1999-2000 to 2001-02**

Average of 3 years data showed that higher grain yield of wheat was recorded from IPNS ($T_3$) and STB fertilizer dose for HYG ($T_2$) followed by $T_1$ and $T_5$. Yield was significantly higher during 2000-01 and 2001-02 but in 1999-2000 identical yield was produced among the different nutrient packages except with FRG '97 ($T_4$) and no fertilizer ($T_6$). STB fertilizer dose for MYG and Farmers' practice produced identical and higher yield over FRG '97. In Jute the highest fibre yield was obtained from $T_3$ followed by $T_2$ and $T_1$. STB fertilizer dose for HYG and MYG also gave similar yield. However, during 2000-01 identical yield was recorded in $T_3$, $T_2$ and $T_1$ but in 1999-2000 and 2001-02 significantly higher yield was found in $T_3$. In T.Aman rice the trend was similar to wheat. Higher yield was recorded from $T_3$ and $T_2$ followed by $T_1$ and $T_5$. However, the trend was little differed over the years. In 2001-02, significantly higher yield was found in $T_3$ followed by $T_2$ but in 2000-01 and 1999-2000 yield did not vary significantly among the treatments except with $T_4$ and no fertilizer (1999-2000). Regarding straw and stick yield almost similar trend was observed in Wheat, T.Aman rice and Jute. Initial soil nutrient status showed that the soil was deficit in N and P and that's why a positive response oh higher level of nutrients was evident.

The cost and return analysis of crops grown in Wheat-Jute-T.Aman cropping pattern showed that the highest gross return and gross margin was obtained from treatment $T_3$ (INM) followed by T2 and T1. But the highest MBCR (5.66) was obtained from treatment $T_4$ (FRG '97) due to use of less amount of fertilizers followed by Farmers' practice. Additional cost for organic manure in T3 reduces the MBCR. Considering the yield and soil fertility for sustaining crop production IPNS practice may be recommended.

Table 10. Yield of Wheat, Jute and T.Aman as affected by fertilizer levels in the cropping pattern Wheat-Jute-T.Aman at Kishoreganj during 1999-2000 to 2001-02

| Treat | Grain/fibre yield (t/ha) | | | Grain/fibre yield (t/ha) | | | Grain/fibre yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001-02 | | | 2000-2001 | | | 1999-2000 | | |
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman |
| $T_1$ | 1.59b | 2.82b | 2.47b | 1.32b | 2.55ab | 3.90a | 1.45ab | 1.55b | 3.98a |
| $T_2$ | 1.86a | 2.83b | 2.95a | 1.53a | 2.71ab | 4.05a | 1.57ab | 1.49bc | 4.11a |
| $T_3$ | 1.66a | 3.42a | 3.13a | 1.59a | 2.93a | 4.43a | 1.76a | 1.83a | 4.06a |
| $T_4$ | 1.46bc | 2.49b | 2.55b | 1.28b | 2.29bc | 3.88a | 1.36bc | 1.31c | 3.56b |
| $T_5$ | 1.42bc | 2.47b | 2.46b | 1.29b | 2.44b | 3.90a | 1.60ab | 1.32c | 3.73ab |
| $T_6$ | 1.20c | 2.06c | 1.69c | 1.00c | 1.85c | 3.04b | 1.03c | 0.99d | 3.01c |
| CV (%) | | | | | | | | | |

Table 10. Contd.

| Treat | Straw/Stick yield (Tk/ha) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2001-02 | | | 2000-2001 | | | 1999-2000 | | |
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman |
| $T_1$ | 2.12b | 3.44b | 4.14b | 1.53b | 3.25ab | 4.82ab | 1.96a | 3.11b | 3.50ab |
| $T_2$ | 2.41a | 3.36bc | 4.95a | 1.76a | 3.22ab | 5.34a | 2.14a | 3.10b | 3.65a |
| $T_3$ | 2.36a | 4.10a | 5.34a | 1.72ab | 3.64a | 4.90ab | 2.30a | 3.49a | 3.49ab |
| $T_4$ | 1.96bc | 2.85d | 4.01b | 1.62b | 2.85bc | 4.56bc | 2.11a | 2.83bc | 3.31b |
| $T_5$ | 1.81cd | 2.92cd | 3.94b | 1.48bc | 3.15ab | 4.69bc | 2.13a | 2.65cd | 3.40b |
| $T_6$ | 1.72d | 2.58d | 2.84c | 1.25c | 2.41c | 4.27c | 1.25b | 2.38d | 3.02c |
| CV (%) | | | | | | | | | |

Figure in the column having similar letter(s) do not differ significantly

Table 11. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as affected by fertilizer levels at Kishoreganj during 1999-2000 to 2001-02 (Avg. of 3 years)

| Treat. | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | | | | |
| $T_1$ | 1.45 | 2.31 | 3.45 | 1.87 | 3.27 | 4.15 | 71090 | 7776 | 63314 | 1.50 |
| $T_2$ | 1.65 | 2.34 | 3.70 | 2.10 | 3.23 | 4.65 | 72830 | 10557 | 62273 | 1.01 |
| $T_3$ | 1.67 | 2.73 | 3.87 | 2.13 | 3.74 | 4.58 | 78240 | 12401 | 65839 | 1.14 |
| $T_4$ | 1.37 | 2.03 | 3.33 | 1.90 | 2.84 | 3.96 | 63845 | 3913 | 59932 | 2.12 |
| $T_5$ | 1.44 | 2.08 | 3.36 | 1.81 | 2.91 | 4.01 | 67205 | 5637 | 61568 | 1.76 |
| $T_6$ | 1.08 | 1.63 | 2.58 | 1.41 | 2.46 | 3.38 | 51655 | 0 | 51655 | - |

**CP : Wheat-Jute-T.Aman**
**Location : Goyeshpur, Pabna (AEZ 11)**
**Year : 2000-01**

During 1999-2000 and 2001-02 grain yield did not vary significantly among the treatments except with control treatment but in 2000-01 treatment $T_2$ and $T_3$ produced significantly higher yield over other treatments. Average of three years data showed that higher grain yield in wheat was recorded from IPNS ($T_3$) and STB fertilizer dose for HYG ($T_2$). Fertilizer doses for MYG (STB & FRG '97) produced similar yield. Initial soil nutrient status data showed that the soil is deficit in NP and S and therefore, a positive effect of higher levels of nutrients was apparent on wheat. However, the trend was slightly varied over the years. Similarly, in Jute the highest fibre yield was obtained from IPNS treatment and the other treatments did not differ appreciably except with control. The trend was more or less same over the year. In T.Aman rice, the higher grain yield was also recorded from $T_3$ and $T_2$ closely followed by Farmers practice ($T_5$). Fertilizer doses for $T_1$ (MYG) and $T_4$ produced similar yield. The trend did not vary markedly over the years. Regarding straw/stick yield of Wheat, Jute and T.Aman rice more or less similar trend was observed.

From cost and return analysis, it was found that the highest gross margin was obtained from IPNS ($T_3$) treatment followed by $T_2$. Similarly, the highest MBCR was calculated from $T_3$ treatment. Based on three years of study IPNS based fertilizer dose could be recommended for the cropping pattern in terms of yield and economic return as well as for sustainable soil fertility.

Table 12. Yield of Wheat, Jute and T.Aman as affected by fertilizer levels in the cropping pattern Wheat-Jute-T.Aman at Goyeshpur, Pabna during 1999-2000 to 2001-02

| Treat | Grain/fibre yield (t/ha) | | | Grain/fibre yield (t/ha) | | | Grain/fibre yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1999-2000 | | | 2000-2001 | | | 2001-02 | | |
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman |
| $T_1$ | 3.18a | 1.51ab | 3.50b | 2.60b | 1.50b | 4.04a | 2.11a | 2.67ab | 4.03ab |
| $T_2$ | 3.29a | 1.12ab | 4.34a | 3.19a | 1.65ab | 4.46a | 2.05a | 2.75ab | 4.33ab |
| $T_3$ | 3.21a | 1.66a | 4.53a | 3.20a | 1.77a | 4.59a | 2.22a | 3.03a | 4.69a |
| $T_4$ | 3.10a | 1.50ab | 3.54b | 2.60b | 1.77a | 4.23a | 2.06a | 2.60ab | 4.00ab |
| $T_5$ | 2.89a | 1.27ab | 4.24a | 2.42b | 1.57ab | 4.14a | 2.08a | 2.71ab | 4.04ab |
| $T_6$ | 1.61b | 0.99b | 1.93c | 1.09c | 0.98c | 2.39b | 1.06b | 2.15b | 3.57b |
| CV (%) | 7.7 | 2.2 | 9.5 | 6.3 | 8.6 | 14.2 | 9.60 | 11.7 | 11.2 |

Table 12. Contd.

| Treat | Straw/Stick yield (Tk/ha) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1999-2000 | | | 2000-2001 | | | 2001-02 | | |
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman |
| $T_1$ | 3.94a | 3.87a | 4.20b | 3.63b | 2.67a | 5.78a | 4.09a | 4.82c | 5.59ab |
| $T_2$ | 3.84a | 3.67a | 5.50a | 4.26a | 2.99a | 5.71a | 5.00a | 6.23ab | 5.49ab |
| $T_3$ | 3.45a | 3.90a | 5.90a | 4.43a | 3.10a | 5.99a | 4.91a | 7.05a | 5.58ab |
| $T_4$ | 3.96a | 3.67a | 4.20b | 3.48b | 2.98a | 6.12a | 4.27a | 5.94bc | 4.73ab |
| $T_5$ | 4.10a | 2.92ab | 5.40a | 3.14c | 2.96a | 5.85a | 4.08a | 5.42bc | 6.30a |
| $T_6$ | 1.99b | 2.51b | 2.40c | 1.60d | 1.82b | 4.24b | 1.99b | 4.80c | 4.05b |
| CV (%) | 13.6 | 15.4 | 9.4 | 6.5 | 11.1 | 11.2 | 15.5 | 9.9 | 15.6 |

Figure in the column having similar letter(s) do not differ significantly

Table 13. Yield, cost and return analysis of Wheat-Jute-T.Aman cropping pattern as affected by fertilizer levels at Goyeshpur, Pabna during 2000-01

| Treat | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR (Tk/ha) | VC (Tk/ha) | GM (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Jute | T.Aman | Wheat | Jute | T.Aman | | | | |
| $T_1$ | 2.63 | 1.89 | 3.98 | 3.89 | 3.79 | 5.19 | 99782 | 7382 | 92400 | 3.67 |
| $T_2$ | 2.84 | 1.84 | 4.48 | 4.37 | 4.30 | 5.57 | 106318 | 8829 | 97489 | 3.65 |
| $T_3$ | 2.88 | 2.15 | 4.60 | 4.26 | 4.68 | 5.82 | 113776 | 8881 | 104895 | 4.46 |
| $T_4$ | 2.59 | 1.96 | 3.92 | 3.90 | 4.20 | 5.02 | 101429 | 7227 | 94202 | 4.00 |
| $T_5$ | 2.46 | 1.85 | 4.14 | 3.77 | 3.77 | 5.85 | 98252 | 8578 | 89674 | 2.84 |
| $T_6$ | 1.25 | 1.37 | 2.63 | 1.88 | 3.04 | 3.56 | 65280 | 0 | 65280 | - |

**CP : Boro-T.Aman**
**Location : Kendua, Kishoreganj (AEZ 9)**
**Year : 2000-01**

Yield data over the years showed that yield of Boro rice did not vary significantly among the treatments except with control, Farmers' practice (2000) and $T_1$ (2001). After three years of experimentation it was observed from the average data that higher grain yield in Boro rice was recorded from $T_3$ and $T_2$ followed by $T_4$ and $T_5$. Similarly in T.Aman rice the highest yield was recorded from $T_3$ in 2000 but followed by $T_2$ in 2002 & 1999. Yield data over the years showed that $T_3$ produced significantly higher yield during 2000 over other treatments but in 2001 and 2002 it was also identical to $T_2$. A positive response of cowdung was apparent towards the yield of the crops. Regarding straw yield more or less similar trend was observed in both the crops.

Cost and return analysis of different nutrient management packages in Boro- T.Aman rice cropping pattern showed higher gross margin in $T_3$ closely followed by $T_5$. But MBCR was higher in $T_5$ followed by $T_4$. However, yield and gross return was higher in $T_3$ and $T_2$ but due to higher fertilization cost the MBCR was less compared with other treatments. Farmers' practice is very close to recommended amount of NPKS and therefore, yield is quite satisfactory. Considering yield and return present fertilizer recommendation (FRG '97) was found superior over other fertilizer packages.

Table 14. Effect of different nutrient management packages on the yield of crops in Boro-T.Aman cropping patterns at Kendua, Kishoreganj during 1999-2000 to 2001-02

| Treatment | 2000 | | 2001 | | 2002 | | Mean of 3 years | |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman |
| | Grain yield (t/ha) | | | | | | | |
| $T_1$ | 5.06ab | 3.78b | 4.33b | 4.10b | 4.44a | 3.55b | 4.61 | 3.88 |
| $T_2$ | 5.41a | 3.74b | 5.16a | 4.20ab | 4.68a | 4.03ab | 5.08 | 3.99 |
| $T_3$ | 5.34a | 4.16a | 5.21a | 4.38a | 4.88a | 4.28a | 5.14 | 4.27 |
| $T_4$ | 4.99ab | 3.77b | 4.94ab | 4.04b | 4.64a | 3.81b | 4.86 | 3.93 |
| $T_5$ | 4.79b | 3.74b | 5.13a | 4.01b | 4.64a | 3.48b | 4.85 | 3.74 |
| $T_6$ | 3.12c | 2.98c | 3.58c | 3.15c | 2.52b | 2.03c | 3.07 | 2.72 |
| CV (%) | | | | | | | | |
| Straw Yield (t/ha) | | | | | | | | |
| $T_1$ | 3.97a | 4.51a | 4.55b | 4.64a | 5.12a | 4.62a | 4.55 | 4.59 |
| $T_2$ | 4.25a | 4.81a | 5.33a | 4.64a | 5.30a | 5.37a | 4.96 | 4.94 |
| $T_3$ | 4.10a | 4.45a | 5.70a | 4.66a | 5.22a | 5.62a | 5.01 | 4.91 |
| $T_4$ | 4.08a | 4.65a | 5.77a | 4.58a | 5.40a | 5.45a | 5.08 | 4.89 |
| $T_5$ | 4.00a | 4.82a | 5.48a | 4.57a | 5.52a | 5.13a | 5.00 | 4.84 |
| $T_6$ | 3.31b | 3.91b | 4.52b | 3.73b | 3.96b | 4.16b | 3.93 | 3.93 |
| CV (%) | | | | | | | | |

Table 15. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Kendua, Kishoreganj during 2000-2002 (average of 3 years)

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.61 | 3.88 | 4.55 | 4.59 | 71913 | 6416 | 65497 | 3.24 |
| $T_2$ | 5.08 | 3.99 | 4.96 | 4.94 | 77859 | 8883 | 68976 | 3.01 |
| $T_3$ | 5.14 | 4.27 | 5.01 | 4.91 | 79487 | 8304 | 71183 | 3.42 |
| $T_4$ | 4.86 | 3.93 | 5.08 | 4.89 | 75233 | 5312 | 69920 | 4.54 |
| $T_5$ | 4.85 | 3.74 | 5.00 | 4.84 | 75121 | 4999 | 70122 | 4.80 |
| $T_6$ | 3.07 | 2.72 | 3.93 | 3.93 | 51110 | 0 | 51110 | - |

**Location : Phulpur, Mymensingh (AEZ 9)**
**Year : 2000-01**

**Phulpur**

During 2001 and 2002 significantly higher grain yield of Boro rice was obtained from $T_3$ and $T_2$ but in 2000 there was no significant difference in yield was found among the different nutrient packages except with no fertilizer. Average of three years data showed that the highest grain yield of Boro rice was recorded from STB fertilizer dose ($T_2$) closely followed by IPNS based fertilizer dose ($T_3$) and FRG '97 ($T_4$). However, the trend was slightly varied over the years. In T.Aman rice, almost similar result was found where the higher grain yield was recorded from the same treatment. However, the yield did not vary markedly among the nutrient packages. The lowest grain yield was obtained from $T_6$ where no fertilizer was applied.

From cost and return analysis it was found that, the highest gross margin was obtained from T2 followed by $T_4$. Similarly, the MBCR was also higher in $T_4$ and $T_2$. In IPNS treatment it was the lowest due to higher fertilization cost for cowdung. Therefore, after three years of experimentation STB fertilizer dose was found superior in terms of yield, profit as well as long term soil fertility of the soil.

Table 16. Effect of different nutrient management packages on the yield of crops in Boro-T.Aman cropping patterns at Phulpur, Mymensingh during 1999-2000 to 2001-02 (av. of 3 years)

| Treatment | 2000 | | 2001 | | 2002 | | Mean of 3 years | |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman |
| | Grain yield (t/ha) | | | | | | | |
| $T_1$ | 4.43ab | 4.03b | 5.19b | 4.14d | 4.26d | 3.80b | 4.62 | 4.32 |
| $T_2$ | 4.92a | 4.50 a | 5.43a | 4.72a | 5.21a | 4.17a | 5.19 | 4.46 |
| $T_3$ | 4.14ab | 4.54a | 5.44a | 4.52b | 5.13a | 4.15a | 4.90 | 4.40 |
| $T_4$ | 4.85a | 4.33ba | 5.16b | 4.29c | 4.78b | 3.88b | 4.93 | 4.17 |
| $T_5$ | 4.77a | 4.08b | 4.60c | 4.16d | 4.58c | 3.81b | 4.65 | 4.02 |
| $T_6$ | 3.67b | 3.08c | 3.24d | 3.24e | 3.08e | 2.88c | 3.33 | 3.07 |
| CV (%) | | | | | | | | |
| | Straw Yield (t/ha) | | | | | | | |
| $T_1$ | 5.22a | 5.33a | 5.97bc | 5.13d | 5.57b | 4.47c | | |
| $T_2$ | 5.25a | 5.57a | 6.17ab | 5.79a | 6.12a | 5.03a | | |
| $T_3$ | 5.27a | 5.59a | 6.25a | 5.66ab | 5.97a | 5.05a | | |
| $T_4$ | 5.27a | 5.43a | 5.87c | 5.51bc | 5.75b | 4.78b | | |
| $T_5$ | 5.23a | 5.30a | 5.36d | 5.36c | 5.30c | 4.01b | | |
| $T_6$ | 4.64b | 4.12b | 4.20e | 4.50e | 4.52d | 3.93d | | |
| CV (%) | | | | | | | | |

Table 17. Yield, cost and return analysis of Boro-T.Aman rice cropping pattern as affected by fertilizer levels at Phulpur, Mymensingh during 1999-2000 to 2001-02(av. of 3 years)

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.62 | 4.32 | 5.59 | 4.98 | 67579 | 5860 | 61719 | 2.99 |
| $T_2$ | 5.19 | 4.46 | 5.85 | 5.44 | 75451 | 7866 | 67586 | 3.26 |
| $T_3$ | 4.90 | 4.40 | 5.83 | 5.43 | 73021 | 10131 | 62890 | 2.21 |
| $T_4$ | 4.93 | 4.17 | 5.63 | 5.24 | 71176 | 6453 | 64720 | 3.30 |
| $T_5$ | 4.65 | 4.02 | 5.30 | 4.89 | 67793 | 6979 | 60814 | 2.51 |
| $T_6$ | 3.33 | 3.07 | 4.45 | 4.18 | 50573 | 0 | 50573 | - |

* Variable Cost = Fertilizer Cost only

**Netrakona**

During the year 2000, significantly higher grain yield was recorded from $T_2$ over other treatments but in 2001 and 2002 yield was identical to $T_3$. Response of higher levels of nutrients was apparent towards the yield of Boro rice. Average of three years data revealed that grain yield of Boro rice did not vary appreciably among the nutrient packages except with control. However, higher yield was obtained from $T_2$ and $T_3$. In T.Aman rice, more or less similar result was observed in grain yield. Grain yield did not differ significantly among the nutrient packages except with control during the year 2000 and 2002. But in 2001, STB fertilizer dose for HYG and IPNS based fertilizer dose produced significantly higher grain yield.

From cost and return analysis, it was found that the highest gross return and margin was obtained from $T_2$ but the higher MBCR was calculated from $T_4$ followed by $T_1$. Cost of over fertilization in $T_3$ gave the lowest MBCR. Considering yield and return present fertilizer recommendation (FRG '97) and STB fertilizer dose for MYG could be suggested for the cropping pattern at Netrakona.

Table 18. Effect of different nutrient management packages on the yield of crops in Boro-T.Aman cropping patterns at Netrakona during 1999-2000 to 2001-02

| Treatment | 2000 | | 2001 | | 2002 | |
|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman |
| | Grain yield (t/ha) | | | | | |
| $T_1$ | 3.98b | 4.18a | 4.86ab | 3.47b | 4.68b | 3.01a |
| $T_2$ | 4.57a | 4.44a | 5.15a | 3.96a | 5.18a | 3.23a |
| $T_3$ | 4.12b | 4.45a | 5.12a | 3.97a | 5.08a | 3.33a |
| $T_4$ | 3.97b | 4.33a | 4.53b | 3.45b | 4.68b | 3.15a |
| $T_5$ | 3.87b | 4.31a | 4.67ab | 2.98c | 4.53c | 3.05a |
| $T_6$ | 2.88c | 2.88b | 3.23c | 2.52d | 2.03d | 2.13b |
| CV (%) | | | | | | |
| | Straw Yield (t/ha) | | | | | |
| $T_1$ | 5.13b | 5.22a | 5.57ab | 3.55b | 6.12b | 4.02a |
| $T_2$ | 5.93a | 5.44a | 6.03a | 4.04a | 6.72a | 4.16a |
| $T_3$ | 5.28b | 5.50a | 6.04a | 4.07a | 6.57a | 4.43a |
| $T_4$ | 5.12b | 5.30a | 5.20b | 3.53b | 6.12b | 4.03a |
| $T_5$ | 4.95b | 5.27a | 5.39b | 3.03c | 5.87c | 4.03a |
| $T_6$ | 3.58c | 3.67b | 3.64c | 2.58d | 2.63d | 2.85b |
| CV (%) | | | | | | |

Table 19. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Netrakona during 1999-2000 to 2001-02 (Avg. of 3 years)

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.51 | 3.55 | 5.65 | 4.26 | 64133 | 7312 | 56821 | 3.29 |
| $T_2$ | 4.97 | 3.88 | 6.27 | 4.55 | 69229 | 9912 | 59317 | 2.93 |
| $T_3$ | 4.77 | 3.92 | 5.96 | 4.65 | 68099 | 12086 | 56009 | |
| $T_4$ | 4.39 | 3.64 | 5.48 | 4.28 | 62958 | 6529 | 56429 | 3.61 |
| $T_5$ | 4.36 | 3.45 | 5.48 | 4.11 | 61149 | 8416 | 52729 | 2.69 |
| $T_6$ | 2.71 | 2.51 | 3.28 | 3.03 | 40777 | 0 | 40777 | - |

* Variable Cost = Fertilizer Cost only

**CP : Boro-T.Aman**
**Location : Satkaniya, Chittagong (AEZ 23)**
**Year : 2000-2002**

After three years of experimentation it was observed from the average data that the highest grain yield in Boro rice was recorded from $T_3$ closely followed by $T_2$. Fertilizer doses for MYG (STB & FRG ’97) produced similar yield. Initial soil nutrient status showed that the soil is deficit with NPKS and therefore, effect of higher levels of nutrients on the grain yield was observed. The trend over the year is almost same. Similarly in T.Aman rice the highest yield was recorded from $T_3$ followed by $T_2$. Treatment $T_1$, $T_4$ and $T_5$ gave almost similar yield. Almost similar trend was observed over the years. Regarding Straw yield more or less similar trend was observed in both the crops.

Cost and return analysis of different nutrient management packages in Boro- T.Aman rice cropping pattern showed that the highest gross margin was obtained from $T_2$ followed by $T_3$ and $T_4$. But the highest MBCR was calculated from $T_4$. Except IPNS ($T_3$) other treatments gave more or less similar MBCR. However, yield and gross return was higher in $T_3$ but due to higher fertilization cost the MBCR was the lowest. Considering yield and return present fertilizer recommendation (FRG ’97) was found superior over other fertilizer packages.

Table 20. Effect of different nutrient management packages on the yield of crops in Boro-T.Aman cropping patterns at Satkaniya, Chittagong during 2000-02

| Treatment | 2000 | | 2001 | | 2002 | |
|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman |
| | Grain yield (t/ha) | | | | | |
| $T_1$ | 5.39 | 4.15 | 4.71 | 4.25 | 4.96 | 4.39 |
| $T_2$ | 5.60 | 4.91 | 5.74 | 4.95 | 5.56 | 5.22 |
| $T_3$ | 5.74 | 4.72 | 5.67 | 5.24 | 5.76 | 5.36 |
| $T_4$ | 5.08 | 4.33 | 4.90 | 4.49 | 5.17 | 4.74 |
| $T_5$ | 4.91 | 4.03 | 4.32 | 4.31 | 4.60 | 4.31 |
| $T_6$ | 2.94 | 2.39 | 3.00 | 2.62 | 3.52 | 3.18 |
| CV (%) | | | | | | |
| | Straw Yield (t/ha) | | | | | |
| $T_1$ | 5.49 | 4.76 | 5.24 | 4.62 | 5.32 | 4.64 |
| $T_2$ | 6.20 | 5.34 | 6.04 | 5.89 | 6.44 | 5.64 |
| $T_3$ | 6.20 | 5.28 | 5.64 | 5.60 | 6.18 | 5.82 |
| $T_4$ | 5.28 | 5.22 | 5.54 | 4.92 | 5.50 | 5.26 |
| $T_5$ | 5.57 | 4.96 | 5.24 | 4.80 | 5.56 | 4.88 |
| $T_6$ | 3.42 | 3.56 | 3.58 | 3.63 | 3.90 | 3.60 |
| CV (%) | | | | | | |

Table 21. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Satkaniya, Chittagong during 2000-02 (Avg. of 3 years)

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 5.02 | 4.26 | 5.35 | 4.67 | 66784 | 6876 | 59908 | 3.46 |
| $T_2$ | 5.63 | 5.03 | 6.23 | 5.62 | 77347 | 9447 | 67900 | 3.63 |
| $T_3$ | 5.72 | 5.11 | 6.01 | 5.57 | 78351 | 13690 | 64661 | 2.58 |
| $T_4$ | 5.05 | 4.52 | 5.44 | 5.13 | 69404 | 5110 | 64294 | 5.16 |
| $T_5$ | 4.61 | 4.22 | 5.46 | 4.88 | 64331 | 5686 | 58645 | 3.75 |
| $T_6$ | 3.15 | 2.73 | 3.63 | 3.60 | 43011 | 0 | 43011 | - |

**Location : Joypurhat, Bogra (AEZ 25)**
**Year : 2001-02**

Grain yield of Boro rice was significantly higher in $T_2$ and $T_3$ followed by $T_1$ and $T_4$. STB fertilizer dose as well as IPNS produced the highest yield. Fertilizer doses for MYG (STB & FRG '97) also gave identical yield. In T.Aman rice the trend was same. Regarding straw yield, however, yield was much higher and it might be due to presence of excess moisture. But the trend was more or less similar to grain yield.

Cost and return analysis showed that higher gross return as well as gross margin was recorded from $T_3$ followed by $T_2$. MBCR in all cases above 3 and varied closely. However, the highest MBCR was found in $T_3$ (IPNS) treatment.

Table 22. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Joypurhat, Bogra during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.39b | 4.14b | 8.76b | 8.86b | 62493 | 7152 | 55521 | 4.00 |
| $T_2$ | 5.24a | 4.67a | 9.98a | 9.21b | 72091 | 9888 | 62203 | 3.86 |
| $T_3$ | 5.26a | 4.78a | 10.01a | 9.80a | 73119 | 9542 | 63577 | 4.10 |
| $T_4$ | 4.35b | 4.17b | 8.98b | 9.15b | 62632 | 7445 | 55187 | 3.86 |
| $T_5$ | 3.83c | 3.67c | 8.24c | 8.04c | 53962 | 6014 | 47948 | 3.33 |
| $T_6$ | 2.72d | 2.13d | 6.15d | 5.37d | 33920 | 0 | 33920 | - |

* Variable Cost = Fertilizer Cost only

**Price:**
Inputs: (Tk./kg)= Urea = Tk. 5.5, TSP =Tk. 14.5, MP= Tk. 9.5, Gypsum= Tk. 3, Zinc Sulphate = Tk. 50
Products Tk./kg)= T.Aman rice Tk. 6.50, Boro rice = Tk. 6.50, Straw = Tk. 0.50

**Location : Feni, Noakhali (AEZ 18)**
**Year : 2001-02**

Grain yield of Boro rice was significantly higher in $T_1$ followed by $T_2$ and $T_3$. STB fertilizer dose for MYG produced higher yield over STB fertilizer dose for HYG and IPNS treatment but the reasons are not clear. Treatment $T_2$ and $T_3$ gave identical yield. Initial soil nutrient status showed that soil is very deficit in nutrient contents but response of higher levels of nutrients was not observed. But in T.Aman rice significantly higher grain yield was obtained from $T_2$ and $T_3$. Response of higher levels of nutrients was evident in T.Aman rice. Similar result was found in case of straw yield of Boro and T.Aman rice. STB fertilizer dose for MYG produced significantly higher yield over FRG ‘97 in all the crops.

Cost and return analysis showed that the highest gross margin was recorded from $T_1$ followed by $T_3$. MBCR was also higher in $T_1$ but due to less fertilization cost it was highest in T4. STB fertilizer dose for MYG was found superior in terms of yield and return.

Table 23. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Feni, Noakhali during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 5.46a | 4.94b | 5.84a | 5.14b | 94470 | 10352 | 84118 | 4.53 |
| $T_2$ | 4.81b | 5.31a | 5.22b | 5.51a | 91995 | 14137 | 77858 | 3.14 |
| $T_3$ | 4.94b | 5.53a | 5.42b | 5.73a | 95250 | 15755 | 79495 | 3.02 |
| $T_4$ | 4.37c | 4.14c | 4.69c | 4.33c | 77355 | 5947 | 71333 | 4.99 |
| $T_5$ | 3.52d | 3.69d | 3.87d | 3.89d | 65715 | 6639 | 59076 | 2.72 |
| $T_6$ | 2.74e | 2.47e | 3.04e | 2.66e | 47625 | 0 | 47625 | - |

* Variable Cost = Fertilizer Cost only

**Price of inputs:** Urea @ Tk.6.00/Kg, TSP @ Tk.15.00/Kg, MP @ Tk.10.00/Kg, Gypsum @ Tk.5.00/Kg, Zinc sulphate @ Tk.40.00/Kg
**Price of outputs:** Grain @ Tk. 7.50 /Kg, Straw @ Tk.1.50/Kg

**Location : Ishan Gopalpur, Faridpur (AEZ 12)**
**Year : 2001-02**

The grain yield of Boro rice varied significantly due to different nutrient packages. Significantly thr highest grain yield was obtained in IPNS ($T_3$) No significant difference was observed among the treatments $T_2$, $T_4$ and farmers' practice ($T_5$). However, Fertilizer dose for MYG from FRG '97 gave significantly higher yield over STB fertilizer dose for MYG. In T.Aman rice, similar result was observed. Almost similar trend was found in straw yield for both the crops. In IPNS treatment where cowdung was applied along with inorganic fertilizers might have played a vital role for uptake of different nutrients which contributed to achieve a comparatively higher yield.

From cost and return analysis of revealed that the highest gross return and margin as well as MBCR were also obtained from treatment $T_3$. Therefore, IPNS based fertilizer dose was found superior in terms of yield, economic return as well as soil fertility.

Table 24. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Ishan Gopalpur, Faridpur during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 5.48c | 5.48c | 6.95c | 6.95c | 63220 | 43910 | 19310 | 1.92 |
| $T_2$ | 5.74bc | 5.74bc | 7.27bc | 7.27bc | 66355 | 45211 | 21144 | 1.97 |
| $T_3$ | 6.56a | 6.56a | 7.81a | 7.81a | 72555 | 47887 | 24668 | 2.01 |
| $T_4$ | 6.00b | 6.00b | 7.54ab | 7.54ab | 64845 | 44465 | 20380 | 1.96 |
| $T_5$ | 5.89bc | 5.89bc | 7.42ab | 7.42ab | 63265 | 48012 | 15253 | 1.49 |
| $T_6$ | 2.84d | 2.84d | 3.67d | 3.67d | 36265 | 29902 | 6363 | -- |

Variable Cost = Fertilizer Cost only

Price of fertilizer: Urea = 6.50 Tk./kg, TSP = 11.00 Tk./kg, MP = 9.00 Tk./kg, Gypsum = 3.00 Tk./kg, Cowdung = 0.40 Tk./kg
Price of product: Boro rice = 7.00 Tk./kg, T.Aman rice = 6.50 Tk./kg, Rice straw = 0.50 Tk./kg

**Location : Norail, Jessore (AEZ 11)**
**Year : 1999-2000 to 2001-02**

Average of three years data showed that grain yield of Boro rice did not varied among the fertilizer treatments except with STB fertilizer dose for MYG ($T_1$) and no fertilizer treatment ($T_6$). STB fertilizer dose for HYG and IPNS treatment failed to show yield increase over FRG '97 based fertilizer dose ($T_4$) and Farmers' practice ($T_5$). Almost similar results were found over the years. However, the initial nutrient status of the soil indicated the nutrient deficiency of the soil but it was not reflected on the yield of Boro rice. In T.Aman rice, higher grain yield was obtained from $T_4$ and $T_5$. IPNS as well as STB fertilizer doses did not considerable effect over other fertilizer doses except with control. The trend was varied slightly over the years. During 1999-2000 significantly higher yield was obtained from $T_5$ and $T_1$ but in 2000-01 and 2001-02 yield was did not differ among the treatments except with no fertilizer. In case of straw yield more or less similar trend was observed for both the rices.

From cost and return analysis it was found that the highest gross margin was calculated from $T_3$ followed by $T_4$. But the highest MBCR was calculated from $T_4$ followed by $T_2$. However the Farmers' practice gave the highest yield and gross return but due to high fertilization cost MBCR was the lowest. Therefore, three years of experimentation it revealed that response of organic manure was not evident on the yield of crops. The present BARC fertilizer recommendation dose ($T_4$) was found optimum for Boro-T.Aman cropping pattern at Norail, Jessore in respect of Yield, cost and return analysis.

Table 25. Effect of different nutrient management packages on the yield of crops in Boro-T.Aman cropping patterns at Norail, Jessore during 1999-2000 to 2001-2002

| Treatment | 1999-2000 | | 2000-2001 | | 2001-2002 | |
|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | Boro | T.Aman |
| | Grain yield (t/ha) | | | | | |
| $T_1$ | 4.93b | 4.64ab | 4.03a | 3.28b | 4.27b | 4.18c |
| $T_2$ | 5.47a | 4.44c | 4.52a | 4.22a | 5.03a | 4.51bc |
| $T_3$ | 5.63a | 4.55bc | 4.90a | 4.47a | 5.06a | 4.94ab |
| $T_4$ | 5.46a | 4.61abc | 4.60a | 4.41a | 5.12a | 5.17a |
| $T_5$ | 5.74a | 4.75a | 4.98a | 4.54a | 5.17a | 4.95ab |
| $T_6$ | 2.25c | 1.61d | 2.70b | 1.85c | 2.68c | 2.30d |
| | Straw Yield (t/ha) | | | | | |
| $T_1$ | 4.12a | 5.65a | 3.74c | 4.08c | 4.58b | 4.70ab |
| $T_2$ | 4.57a | 5.40a | 4.23b | 5.17b | 4.96ab | 4.62b |
| $T_3$ | 4.58a | 5.78a | 4.74a | 5.46a | 5.36a | 5.18ab |
| $T_4$ | 4.57a | 5.62a | 4.13b | 5.44ab | 5.07ab | 5.32a |
| $T_5$ | 4.51a | 5.73a | 4.79a | 5.52a | 5.32a | 5.24ab |
| $T_6$ | 2.59b | 4.08b | 1.90d | 1.88d | 2.52c | 2.88c |

Table 26. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Norail, Jessore during 1999-2000 to 2001-02 (Avg. of 3 years)

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.41 | 4.03 | 4.15 | 4.14 | 60669 | 3865 | 56804 | 6.94 |
| $T_2$ | 5.01 | 4.39 | 4.59 | 5.06 | 70948 | 5256 | 65692 | 7.06 |
| $T_3$ | 5.18 | 4.65 | 4.89 | 5.47 | 73473 | 6416 | 67057 | 6.18 |
| $T_4$ | 5.06 | 4.73 | 4.59 | 5.46 | 71870 | 4828 | 67042 | 7.88 |
| $T_5$ | 5.29 | 4.75 | 4.87 | 5.49 | 74747 | 13546 | 61201 | 3.02 |
| $T_6$ | 2.54 | 1.92 | 2.34 | 2.95 | 33813 | 0 | 33813 | - |

* Variable Cost = Fertilizer Cost only

Inputs and outputs:

Price (Tk./ka): Boro rice= 7.00, .T.Aman=7.00, Straw=0.75, Urea= 6.00, TSP=12.00, MP= 8.50, Gypsum= 3.00, Zinc Sulphate= 60.00

**Location : Sujanagar, Pabna (AEZ 11)**
**Year : 2001-02**

Significantly higher grain yield in Boro rice was recorded from $T_3$ and $T_2$ followed by $T_1$, $T_4$ and $T_5$. As the soil was deficit with nutrients and therefore effect of higher doses of nutrients was evident in Boro rice. However fertilizer doses for MYG (STB & FRG '97) along with Farmers' practice produced identical yield. But in T.Aman rice grain yield did not vary significantly among the different nutrient packages except with $T_4$ and $T_6$. More or less the trend was same in case of straw yield. From cost and return analysis it was found that the highest gross margin as well as MBCR was obtained from IPNS ($T_3$) treatment followed by STB fertilizer dose for HYG ($T_2$) & $T_4$.

Table 27. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Sujanagar, Pabna during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 4.23b | 4.29ab | - | 6.78ab | 69720 | 6503 | 63217 | 2.74 |
| $T_2$ | 5.51a | 4.39ab | - | 6.32b | 80340 | 7874 | 72466 | 3.44 |
| $T_3$ | 5.46a | 4.72a | - | 6.92a | 83875 | 8651 | 75224 | 3.46 |
| $T_4$ | 4.45b | 4.03b | - | 6.13b | 69335 | 5422 | 64013 | 3.43 |
| $T_5$ | 4.22b | 4.29ab | - | 6.71ab | 69605 | 7401 | 62204 | 2.27 |
| $T_6$ | 2.22c | 3.32c | - | 5.13c | 45415 | 0 | 45415 | - |

* Variable Cost = Fertilizer Cost only

**Location : Kolaroa, Khulna (AEZ 13)**
**Year : 2001-02**

**Kolaroa**

Significantly higher grain yield of Boro rice was recorded from $T_3$ where STB fertilizer dose along with organic manure was applied but identical to STB fertilizer dose for HYG ($T_2$). However, the other treatments produced identical yield and only differed with no fertilizer treatment. In T.Aman rice the highest grain yield was recorded from Farmers' practice ($T_5$) which was also identical to $T_2$ and $T_3$. Traditionally the farmers' of that are applied a high dose of inorganic fertilizers. Regarding straw yield no significant difference was observed in Boro rice among the treatments except with no fertilizer. But in T.Aman rice significantly higher straw yield was obtained from $T_5$ and the other treatments did not vary significantly except with no fertilizer.

Cost and return analysis showed that the highest gross margin was obtained from $T_3$ followed by $T_2$ and $T_5$. But the MBCR was highest in $T_4$. In other cases the MBCR is less than $T_3$. Due to additional cost for organic manure increased the fertilization cost and reduced MBCR in $T_3$.

Table 28. Yield, cost and return analysis of Boro -T.Aman rice cropping pattern as affected by fertilizer levels at Kolaroa MLT site, Khulna during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Boro | T.Aman | | | | |
| $T_1$ | 5.37b | 3.90cd | 5.50a | 4.50bc | 69,890 | 6,992 | 62,898 | 2.69 |
| $T_2$ | 5.87ab | 4.70ab | 6.12a | 5.20b | 79,650 | 9,791 | 69,859 | 2.91 |
| $T_3$ | 6.37a | 4.90ab | 6.52a | 5.15b | 84,725 | 13,667 | 71,058 | 2.46 |
| $T_4$ | 5.37b | 4.30bc | 6.12a | 5.20b | 73,365 | 6,764 | 66,891 | 3.29 |
| $T_5$ | 5.75b | 5.10a | 6.25a | 6.10a | 82,125 | 12,675 | 69,450 | 2.45 |
| $T_6$ | 3.37c | 3.37d | 3.75b | 4.12c | 51,115 | 0 | 51,115 | - |

- Variable Cost = Fertilizer Cost only

**Price** (Tk/kg)= Urea = 6.00, TSP= 14.00, MP= 10.00, Gypsum= 4.00, $ZnSO_4$= 80.00, Cow dung=0.50, Rice grain= 7.00, Rice straw= 0.50

**Location :Dumuria, Khulna (AEZ 13)**
**Year : 2001-02**
**CP : Sesame - T.Aman**

Higher seed yield of Sesame was recorded from $T_2$ but statistically at par to $T_3$. Fertilizer doses for MYG (STB & FRG '97) also produced identical yield. The lowest yield was recorded from Farmers' practice ($T_5$). Absolute control treatment was not included in this treatment. In T.Aman rice significantly higher grain yield was recorded from STB fertilizer dose for HYG ($T_2$). Other treatments did not vary significantly except with Farmers' practice. Regarding straw yield almost similar trend was observed.

Cost and return analysis showed that the highest gross margin was obtained from $T_2$. Similarly, MBCR was highest in the same treatment.

Table 29. Yield, cost and return analysis of Sesame-T.Aman rice cropping pattern as affected by fertilizer levels at Dumuria MLT site, Khulna during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Sesame | T.Aman | Sesame | T.Aman | | | | |
| $T_1$ | 1112b | 4.15b | 3250b | 5.34b | 48,314 | 4,262 | 44,052 | 1.53 |
| $T_2$ | 1239a | 4.46a | 3612a | 6.05a | 52,725 | 5,577 | 47,148 | 1.96 |
| $T_3$ | 1218a | 4.22b | 3675a | 6.23a | 50,946 | 7,229 | 43,717 | 1.26 |
| $T_4$ | 1113b | 4.03b | 3200b | 5.31b | 47,421 | 4,262 | 43,159 | 1.33 |
| $T_5$ | 956c | 3.65c | 2525c | 4.45c | 41,772 | -- | 41,772 | -- |

- Variable Cost = Fertilizer Cost only

**Price** (Tk/kg): Urea= 6.00, Gypsum= 4.00, TSP= 14.00, Cowdung= 0.50, MP= 10.00, Sesame= 12.00, $ZnSO_4$= 80.00, Sesame straw= 1.00, Rice grain= 7.00, Rice straw= 0.50

**CP : Groundnut-T.Aman (AEZ 18)**
**Location : Atkapalia, Noakhali**
**Year : 2001-02**

Nut yield of Ground nut did not vary significantly among the different nutrient packages except with no fertilizer. Effect of IPNS as well as higher levels of nutrients on the yield of Ground nut was not evident. Yield was identical even with Farmers' practice also. But in T.Aman rice significantly higher grain yield was recorded from IPNS ($T_3$) and FRG '97 ($T_4$) treatments. Other treatments produced more or less similar yield except in control plot. Almost same trend was observed regarding stover and straw yield of Ground nut and T.Aman rice, respectively.

Cost and return analysis showed that higher gross return as well as gross margin was obtained from $T_4$. MBCR was also highest in the same treatment. Present fertilizer recommendation (FRG '97) was found superior in terms of yield and return.

Table 30. Effect of different nutrient packages on agro-economics performance of Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali during 2001-02

| Treatment | Nut/Grain yield (t/ha) | | Stover/Straw yield(t/ha) | | Gross return (Tk/ha) | Variable cost Tk/ha | Gross margin (Tk/ha) | MBCR (Over control) |
|---|---|---|---|---|---|---|---|---|
| | Groundnut | T.Aman | Groundnut | T.Aman | | | | |
| $T_1$ | 2.53a | 3.57bc | 3.41ab | 3.80b | 69378 | 5403 | 63975 | 2.58 |
| $T_2$ | 2.70a | 3.64b | 2.88bc | 3.99b | 72510 | 7083 | 65427 | 2.41 |
| $T_3$ | 2.43a | 4.33a | 3.17ab | 4.76a | 74478 | 8732 | 65746 | 2.18 |
| $T_4$ | 2.40a | 4.41a | 3.40ab | 4.43a | 74355 | 4621 | 69734 | 4.08 |
| $T_5$ | 2.25ab | 3.31bc | 3.59a | 4.00b | 63473 | 4043 | 59430 | 1.98 |
| $T_6$ | 1.81b | 3.20c | 2.45c | 3.70b | 55463 | 0 | 55463 | - |

**Price of inputs:** Urea @ Tk.6.00/Kg, TSP @ Tk.14.00/Kg, MP @ Tk.10.00/Kg, Gypsum @ Tk.5.00/Kg, Zinc sulphate @ Tk.50.00/Kg
**Price of outputs:** Groundnut @ Tk. 15.00/Kg, Stover@ Tk.0.25/Kg, Grain @ Tk. 7.50/Kg, Straw @ Tk.1.00/Kg

**CP : Groundnut-T.Aman (AEZ 18)**
**Location : Laxmipur, Noakhali**
**Year : 2001-02**

Nut yield of Ground varied significantly among the different nutrient packages and the highest yield was recorded from $T_3$. Between the two fertilizer doses for MYG, significantly higher yield was obtained from STB fertilizer dose ($T_1$) over FRG '97 ($T_4$). In T.Aman rice higher grain yield was recorded from IPNS ($T_3$) closely followed by STB fertilizer dose for HYG ($T_2$). More or less similar trend was observed regarding stover and straw yield of Ground nut and T.Aman rice, respectively.

Cost and return analysis showed that higher gross return as well as gross margin was obtained from $T_3$ followed by $T_2$. But MBCR was highest in $T_1$ due to less fertilization cost compared to $T_3$ and $T_2$.

Table 31. Effect of different nutrient packages on agro-economics performance of Groundnut-T.Aman cropping pattern at Laxmipur, Noakhali during 2001-02

| Treatment | Nut/Grain yield (t/ha) | | Stover/Straw yield(t/ha) | | Gross return (Tk/ha) | Variable cost Tk/ha | Gross margin (Tk/ha) | MBCR (Over control) |
|---|---|---|---|---|---|---|---|---|
| | Groundnut | T.Aman | Groundnut | T.Aman | | | | |
| $T_1$ | 2.23c | 4.81b | 2.61c | 5.72c | 76044 | 4856 | 71188 | 7.10 |
| $T_2$ | 2.34b | 5.11a | 3.12b | 6.27b | 80638 | 6483 | 74150 | 6.03 |
| $T_3$ | 2.58a | 5.22a | 3.27a | 6.48a | 85248 | 8115 | 77133 | 5.39 |
| $T_4$ | 1.86d | 4.56c | 2.66c | 4.93d | 68156 | 4804 | 63352 | 5.54 |
| $T_5$ | 1.40e | 3.93d | 2.19d | 4.17e | 55716 | 2427 | 52989 | 5.19 |
| $T_6$ | 1.02f | 2.99e | 1.21e | 3.09f | 41537 | 0 | 41537 | - |

**Price of inputs:** Urea @ Tk.6.50/Kg, TSP @ Tk.14.00/Kg, MP @ Tk.10.00/Kg, Gypsum @ Tk.5.00/Kg, Zinc sulphate @ Tk.60.00/Kg

**Price of outputs:** Groundnut @ Tk. 14.00/Kg, Stover@ Tk.0.25/Kg, Grain @ Tk. 8.00/Kg, Straw @ Tk.1.00/Kg

**CP : Groundnut-T.Aman (AEZ 11)**
**Location : Natore, Rajshahi**
**Year : 2001-02**

Nut yield of Groundnut varied significantly among the different nutrient packages and higher nut yield was recorded from $T_4$ followed by $T_1$. It was observed that STB fertilizer dose for HYG as well as IPNS treatment failed to produce higher yield over fertilizer doses for MYG (STB & FRG '97). In T.Aman rice grain yield did not vary significantly among the different nutrient packages except with Farmers practice and no fertilizer treatment. However farmers usually apply a high dose of NPK in T.Aman rice even higher than recommended rate but yield was lower compared with recommended fertilizer dose. Initial soil nutrient status showed that the soil is deficit with S and Zn but farmers' did not apply any S and Zn fertilizer which might be responsible for lower yield. Stover yield of Groundnut did not vary significantly among the treatments except with Farmers' practice and control. Similarly straw yield of T.Aman rice did not differ significantly except with control treatment.

Cost and return analysis showed that higher gross return and gross margin as well as was MBCR was obtained from but slightly higher MBCR from treatment $T_1$ than $T_4$. Considering yield and return STB fertilizer dose for MYG as well as fertilizer dose from FRG '97 could be suggested for the cropping pattern at Rajshahi.

Table 32. Effect of different nutrient packages on agro-economics performance of Groundnut-T.Aman cropping pattern at Natore, Rajshahi during 2001-02

| Treatment | Nut/Grain yield (t/ha) | | Stover/Straw yield(t/ha) | | Gross return (Tk./ha) | Variable cost Tk./ha | Gross margin (Tk./ha) | MBCR (Over control) |
|---|---|---|---|---|---|---|---|---|
| | Groundnut | T.Aman | Groundnut | T.Aman | | | | |
| $T_1$ | 2.02ab | 4.68a | 7.6a | 4.97a | 70555 | 3945 | 66610 | 8.37 |
| $T_2$ | 1.91b | 4.67a | 7.6a | 4.90a | 68629 | 5184 | 63445 | 6.00 |
| $T_3$ | 1.76bc | 4.50a | 7.9a | 4.85a | 64950 | 4336 | 60614 | 6.32 |
| $T_4$ | 2.15a | 4.50a | 7.7a | 4.70a | 71137 | 4049 | 67088 | 8.30 |
| $T_5$ | 1.59c | 3.83b | 6.9b | 4.37a | 57017 | 5091 | 51926 | 3.83 |
| $T_6$ | 1.24d | 2.16c | 5.8c | 2.25b | 37520 | 0 | 37520 | - |

**CP : Potato-T.Aman**
**Location : Barind, Rajshahi (AEZ 26)**
**Year : 2001 - 2002**

Tuber yield varied significantly among different treatments. Significantly highest tuber yield (23.09 t/ha) was produced by farmers' practice ($T_5$) followed by $T_4$ and $T_3$. Soil test based fertilizer dose for MYG and HYG failed to show better performance over other treatments. However, the soil of Barind has very low nutrient status and organic matter content is also very low but application of cowdung @ 10 t/ha did not have any positive effect on tuber yield. Farmers generally apply a high dose of NPK in Potato which is much higher than the recommended dose.

In T.Aman rice significantly higher yield was recorded from $T_2$ and $T_3$. A considerable residual effect of cowdung applied in Potato was apparent in grain yield of T.Aman rice. Treatment T1, T4 and T5 produced identical yield. More or less similar trend was observed in stover/straw yield of Potato and T.Aman rice. Yield of crops varied mainly due to difference in N fertilizer doses. Treatment comprising higher dose of N gave higher yield.

Cost and return analysis results showed that the highest gross return as well as gross margin was recorded from $T_4$ followed by $T_3$. The highest MBCR was calculated from IPNS treatment ($T_3$) followed by $T_4$. Fertilization cost was much higher in Farmers' practice ($T_5$) due to over fertilization in Potato. Therefore, MBCR was lowest in $T_5$.

Table 33. Yield, cost and return analysis of Potato-T.Aman rice cropping pattern as affected by fertilizer levels at Chabbishnagar, Barind, Rajshahi during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Potato | T.Aman | Potato | T.Aman | | | | |
| $T_1$ | 13.75d | 3.82b | 2.96d | 4.20b | 85940 | 11620 | 74320 | 2.15 |
| $T_2$ | 18.31c | 4.60a | 3.50c | 5.37a | 109894 | 15526 | 94368 | 3.15 |
| $T_3$ | 19.12c | 4.49a | 3.83b | 5.24a | 113150 | 15491 | 97659 | 3.37 |
| $T_4$ | 20.69b | 3.98b | 4.03ab | 4.04b | 114660 | 15981 | 97679 | 3.16 |
| $T_5$ | 23.09a | 3.81b | 4.25a | 3.92b | 112950 | 21390 | 91560 | 2.43 |
| $T_6$ | 9.71e | 2.72c | 1.69e | 3.05c | 60930 | 0 | 60930 | - |

* Variable Cost = Fertilizer Cost only

**Price Tk./kg) =** Urea =6.00, TSP= 13.00, MP= 9.00, Gypsum= 4.00, Boric acid= 110.00, $ZnSO_4$= 30.0, Cowdung= 0.05, Rice grain= 7.00, Rice straw= 1.00, Tuber= 4.00

**CP : Potato-T.Aman**
**Location : Paba, Rajshahi (AEZ 11)**
**Year : 2001 - 2002**

Tuber yield of Potato did not vary significantly among the different nutrient packages except with no fertilizer treatment. Response of higher levels of nutrients as well as organic manure was not observed. Traditionally the farmers use a very high dose of NPK in Potato but yield was identical to other treatments. In T.Aman rice similar trend was observed. Grain yield did not vary significantly except with control.

Cost and return analysis results showed that the highest gross return as well as gross margin was recorded from $T_4$ but MBCR was slightly higher in $T_1$ and $T_4$. Due to over fertilization cost the MBCR was the lowest in Farmers' practice ($T_5$). Fertilizer dose for MYG (STB & FRG '97) could be suggested for the cropping pattern at Rajshahi in terms of yield and economic return.

Table 34. Yield, cost and return analysis of Potato-T.Aman rice cropping pattern as affected by fertilizer levels at Paba, Rajshahi during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Potato | T.Aman | Potato | T.Aman | | | | |
| $T_1$ | 24.2a | 3.40a | 26.9a | 3.56b | 148335 | 3857 | 144478 | 16.9 |
| $T_2$ | 26.0a | 3.96a | 29.2a | 4.19a | 161912 | 5521 | 156391 | 13.9 |
| $T_3$ | 22.6a | 4.02a | 25.8a | 4.24a | 145361 | 5175 | 140186 | 11.6 |
| $T_4$ | 26.4a | 3.95a | 29.7a | 4.16a | 163824 | 5216 | 158608 | 15.0 |
| $T_5$ | 24.6a | 3.71a | 28.6a | 4.08a | 153053 | 17411 | 147837 | 3.9 |
| $T_6$ | 12.5b | 2.80b | 18.8b | 2.96c | 85084 | 0 | 85084 | - |

* Variable Cost = Fertilizer Cost only

**CP : Potato-Boro-T.Aman rice**
**Location : Syedpur, Rangpur (AEZ 3)**
**Year : 2001-02**

**Potato**

Significantly highest tuber yield was recorded from farmers' practice ($T_5$). In farmers practice, they used a higher dose of fertilizers along with micronutrients (Zn and B) and organic manure in Potato which might be contributed to higher yield. Two MYG fertilizer doses (STB & FRG '97) also produced identical yield. But in Boro and T.Aman rice significantly higher grain yield was recorded from STB fertilizer dose for HYG ($T_2$) and IPNS treatment ($T_3$). Fertilizer doses for MYG (STB & FRG '97) and Farmers' practice produced identical yield. Straw yield of Boro rice did not vary significantly among the treatments except with $T_4$ (FRG '97) and $T_6$ (control). But in T.Aman rice higher and identical straw yield was recorded from $T_2$, $T_3$ and $T_1$. In all the cases the control treatment gave the lowest grain and straw yield in both the rice crops.

Cost and return analysis showed that higher gross return as well as gross margin was calculated from $T_2$ and $T_3$ followed by Farmers' practice ($T_5$). But MBCR was the highest in $T_4$ (FRG '97) due to less fertilization cost. Similarly, due to higher fertilization cost MBCR was less in $T_3$ and $T_5$.

Table 35. Yield, cost and return analysis of Potato-Boro-T.Aman cropping pattern as affected by fertilizer levels at Syedpur FSRD site, Rangpur during 2001-02

| Treat | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR | VC | GM | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Potato | Boro | T.Aman | Potato | Boro | T.Aman | | | | |
| $T_1$ | 22.84c | 4.36b | 4.21b | - | 5.90ab | 5.78ab | 142920 | 10940 | 131980 | 6.65 |
| $T_2$ | 25.63b | 4.88a | 4.95a | - | 6.22a | 6.31a | 161795 | 15566 | 146229 | 5.89 |
| $T_3$ | 26.08b | 4.91a | 5.07a | - | 6.12ab | 6.20a | 164240 | 18886 | 145354 | 4.98 |
| $T_4$ | 22.33c | 4.19b | 4.11b | - | 5.33b | 5.42b | 138765 | 8510 | 130255 | 8.06 |
| $T_5$ | 28.67a | 4.10b | 4.18b | - | 5.75ab | 5.55b | 157900 | 17372 | 140528 | 5.05 |
| $T_6$ | 10.72d | 2.09c | 2.25c | - | 3.48c | 3.08c | 70160 | 0 | 70160 | - |

Means followed by the same letter(s) in a column are not significantly different at 5% level by DMRT.

**CP : Potato-T.Aus-T.Aman**
**Location : Chandina, Comilla (AEZ 19)**
**Year : 2000-01**

Average of three years study reveal that the highest tuber yield was recorded from Farmers practice ($T_5$) which is closely followed by STB fertilizer dose for HYG ($T_2$). IPNS based fertilizer dose ($T_3$) did show better performance over $T_2$ and $T_5$ but produced higher yield over $T_1$ and $T_4$. Fertilizer doses for MYG ($T_1$ and $T_4$) also gave similar yield. The lowest yield was recorded from no fertilizer ($T_6$)

treatment. The trend over the years are almost same and higher yield was obtained from $T_5$ followed by $T_3$ in 1999-2000 and 2000-01 but $T_5$, $T_2$ and $T_1$ in 2001-02.

The grain yield of T.Aus rice did not vary markedly among the treatments except with control treatment. However, the data over the years varies slightly and it was found that during 1999-2000 and 2000-01 identical and higher yield was obtained from $T_2$, $T_3$ and $T_5$ but in 2001-02 yield was did not vary among the treatments except with control. Similarly, In T.Aman rice, grain yield did not vary among the treatments except with $T_1$ and $T_6$. Almost similar trend was found over the years and during 2001-02 yield was varied only with control treatment.

From cost and return analysis it was found that the highest gross margin was obtained from $T_2$ followed by $T_3$. Similarly MBCR was also higher in the same treatment. Fertilizer doses for MYG ($T_1$ and $T_4$) gave similar value. Farmers' traditionally apply a very high dose of fertilizers in Potato and yield was quiet high. But due to higher fertilization cost gross margin was less and MBCR was the lowest. Based on three years of experimentation STB fertilizer dose for HYG ($T_2$) as well as IPNS ($T_3$) treatment was found superior in terms of yield, economic performance and sustainable soil fertility.

Table 36. Yield of crops in Potato-T.Aus-T.Aman cropping pattern as affected by fertilizer levels at Chandina, Comilla during 1999-2000 to 2001-02

| Treatment | Yield of 1st year (t/ha) | | | Yield of 2nd year (t/ha) | | | Yield of 3rd year (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Potato | T.Aus | T.Aman | Potato | T.Aus | T.Aman | Potato | T.Aus | T.Aman |
| $T_1$ | 15.96bc | 4.5b | 3.4b | 15.46c | 4.80bc | 3.43bc | 12.25bc | 4.05a | 4.46a |
| $T_2$ | 17.52ab | 5.15ab | 3.8ab | 18.23ab | 5.00ab | 3.83b | 19.30a | 4.25a | 4.93a |
| $T_3$ | 16.84b | 5.57a | 3.9a | 15.92bc | 5.10a | 4.32a | 16.50ab | 4.18a | 4.90a |
| $T_4$ | 16.2bc | 4.88b | 3.5b | 15.92bc | 4.93b | 4.05a | 12.50bc | 4.04a | 4.69a |
| $T_5$ | 18.79a | 5.45a | 4.0a | 20.88a | 5.09ab | 4.12a | 20.00a | 4.35a | 4.30a |
| $T_6$ | 6.1d | 3.5c | 1.9c | 6.23d | 3.52d | 3.18c | 7.13c | 2.91b | 2.97b |

Table 37. Yield, cost and return analysis of Potato-T.Aus-T.Aman cropping pattern as affected by fertilizer levels at Chandina, Comilla during 1999-2000 to 2001-02 (Avg. of 3 year)

| Treat | Grain yield (t/ha) | | | GR | VC | GM | MBCR |
|---|---|---|---|---|---|---|---|
| | Potato | T.Aus | T.Aman | | | | |
| $T_1$ | 14.56 | 4.45 | 3.76 | 357125 | 33994 | 323131 | 4.29 |
| $T_2$ | 18.35 | 4.80 | 4.19 | 412850 | 39162 | 373688 | 5.14 |
| $T_3$ | 16.42 | 4.95 | 4.37 | 399510 | 34887 | 364623 | 5.39 |
| $T_4$ | 14.87 | 4.62 | 4.08 | 369800 | 33641 | 336159 | 4.70 |
| $T_5$ | 19.89 | 4.96 | 4.14 | 430620 | 82548 | 348072 | 2.65 |
| $T_6$ | 6.49 | 3.31 | 2.68 | 211405 | 0 | 211405 | - |

* Variable Cost = Fertilizer cost only.

**Price (Tk./ka):** Potato=3.50, T.Aus rice= 7.00, T.Aman= 7.00, Rice straw= 1.00, Urea = 6.00, TSP=12.00, MP = 9.00, Gypsum= 4.00, Cowdung= 0.50, Zn= 100.00,

**CP : Onion-T.Aus-T.Aman**
**Location : Kushtia (AEZ 11)**
**Year : 1999-2000 to 2001-02**

Application of fertilizers significantly increased the bulb yield of onion. Average of three years data showed that the highest bulb yield was recorded from IPNS based fertilizer dose ($T_3$) followed by STB fertilizer dose for HYG ($T_2$). Effect of higher levels of fertilizer and organic manure was evident in Onion. Fertilizer dose from FRG '97 ($T_4$) and Farmers practice produced similar yield and higher than STB fertilizer dose for MYG. The soil was deficit in N and P and the status of P was very low. Effect of P on the yield of Onion was apparent. In T.Aus rice, grain yield did not vary appreciably among the treatments except with control. However the higher yield was recorded from IPNS treatment. In T.Aman rice almost similar trend was found. Grain yield differed mainly with $T_1$ and $T_6$

treatment and other treatments produced more or less similar yield. In case of straw yield almost similar trend was observed. The trend of product and by product yield was similar over the years.

The highest gross margin and return as well as MBCR was found in IPNS ($T_3$) followed by Farmers' practice. Among the fertilizer packages treatment $T_1$ where STB fertilizer dose for MYG was applied produced lowest gross margin and MBCR. Based on three years of experimentation IPNS based fertilizer dose could be recommended for higher yield, income as well as for long term soil fertility.

Table 38. Yield of crops as affected by fertilizer levels in the cropping pattern Onion-T.Aus -T.Aman cropping pattern at Kushtia during 1999-2000 to 2001-02

| Treat | Bulb/Grain yield (t/ha) | | | Bulb/Grain yield (t/ha) | | | Bulb/Grain yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1999-2000 | | | 2000-2001 | | | 2001-02 | | |
| | Onion | T.Aus | T.Aman | Onion | T.Aus | T.Aman | Onion | T.Aus | T.Aman |
| $T_1$ | 8.87 | 3.16 | 3.69 | 9.26 | 3.75 | 3.52 | 10.3 | 3.25 | 4.20 |
| $T_2$ | 11.16 | 3.43 | 4.28 | 10.97 | 3.90 | 3.87 | 11.59 | 3.35 | 4.83 |
| $T_3$ | 11.12 | 3.55 | 4.58 | 12.99 | 4.00 | 3.99 | 13.52 | 4.29 | 4.83 |
| $T_4$ | 9.52 | 3.20 | 4.24 | 11.48 | 3.98 | 3.85 | 11.21 | 4.00 | 4.91 |
| $T_5$ | 9.87 | 3.25 | 4.17 | 10.87 | 3.91 | 3.74 | 11.61 | 3.33 | 4.59 |
| $T_6$ | 8.03 | 2.60 | 3.06 | 8.42 | 3.22 | 3.35 | 9.31 | 2.91 | 3.11 |
| CV (%) | | | | | | | | | |

Table 38. Contd.

| Treat | Straw yield (t/ha) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1999-2000 | | | 2000-2001 | | | 2001-02 | | |
| | Onion | T.Aus | T.Aman | Onion | T.Aus | T.Aman | Onion | T.Aus | T.Aman |
| $T_1$ | - | 3.93a | 5.85a | - | 3.96a | 4.50a | - | 3.21cd | 4.45a |
| $T_2$ | - | 4.40a | 6.15a | - | 4.12a | 4.58a | - | 3.44bc | 4.60a |
| $T_3$ | - | 4.11a | 6.45a | - | 4.42a | 4.88a | - | 3.87a | 4.80a |
| $T_4$ | - | 4.03a | 6.01a | - | 4.42a | 4.49a | - | 3.79a | 4.55a |
| $T_5$ | - | 4.12a | 6.26a | - | 4.10a | 4.91a | - | 3.58ab | 4.66a |
| $T_6$ | - | 3.14b | 4.08b | - | 3.25b | 3.86b | - | 3.08d | 3.10b |
| CV (%) | | | | | | | | | |

Figure in the column having similar letter(s) do not differ significantly

Table 39. Yield, cost and return analysis of Onion-T.Aus-T.Aman cropping pattern as affected by fertilizer levels at Kushtia during 1999-2000 to 2001-02 (Avg. of 3 years)

| Treat. | Grain yield (t/ha) | | | Stover/ straw yield (t/ha) | | | GR | VC | GM | MBCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Onion | T.Aus | T.Aman | Onion | T.Aus | T.Aman | | | | |
| $T_1$ | 9.5 | 3.37 | 3.80 | - | 3.61 | 4.93 | 198860 | 14458 | 184402 | 1.54 |
| $T_2$ | 11.2 | 3.56 | 4.33 | - | 3.99 | 5.11 | 229945 | 15494 | 214451 | 3.44 |
| $T_3$ | 12.5 | 3.93 | 4.45 | - | 4.13 | 5.38 | 253140 | 17813 | 235327 | 4.29 |
| $T_4$ | 10.7 | 3.73 | 4.33 | - | 4.08 | 5.02 | 223635 | 14870 | 208765 | 3.16 |
| $T_5$ | 10.8 | 3.48 | 4.17 | - | 3.93 | 5.28 | 222240 | 12192 | 210048 | 3.74 |
| $T_6$ | 8.6 | 2.91 | 3.17 | - | 3.32 | 3.68 | 176645 | 0 | 176645 | - |

* Variable Cost = Fertilizer cost only.

Price: Onion - Tk. 15.00/kg, T.Aus - Tk. 7.00/kg, T.Aman - Tk. 7.50/kg. Straw Tk. 0.50/kg

**CP : T.Aus-T.Aman**
**Location : Golapganj and Moulvibazar, Sylhet (AEZ 20)**
**Year : 2001-02**

Higher and identical grain yield of T.Aus rice was recorded from $T_3$ and $T_2$ followed by $T_1$. Fertilizer dose from FRG '97 ($T_4$) and Farmers' practice gave identical yield and the lowest was recorded from no fertilizer treatment. Similarly, effect of cowdung was not evident in T.Aus rice. In T.Aman rice, almost similar result was found from the same treatment ($T_2$ and $T_3$). Regarding straw yield in T.Aus rice, higher and identical yield was recorded from $T_2$, $T_3$ and $T_1$. But in T.Aman rice significantly higher yield was obtained from $T_2$ and $T_3$. Results did not vary over the locations-Golapganj and Moulvibazar.

Cost and return analysis showed that the highest gross margin was obtained from $T_2$ followed by $T_3$. But the highest MBCR was calculated from $T_1$ followed by $T_2$. Due to additional cost for organic manure in $T_3$, the MBCR was the lowest. Same trend was found at Moulvibazar.

Table 40. Yield, cost and return analysis of T.Aus -T.Aman rice cropping pattern as affected by fertilizer levels at Golapganj FSRD site, Sylhet during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | T.Aus | T.Aman | T.Aus | T.Aman | | | | |
| $T_1$ | 4.81b | 4.98b | 5.87a | 6.23b | 75801 | 5076 | 70725 | 7.24 |
| $T_2$ | 5.17a | 5.32a | 6.31a | 6.81a | 81321 | 6573 | 74749 | 6.43 |
| $T_3$ | 5.15a | 5.30a | 6.26a | 6.70a | 81037 | 9649 | 71388 | 4.35 |
| $T_4$ | 3.25c | 3.48d | 4.45b | 5.08c | 54502 | 2825 | 51677 | 5.48 |
| $T_5$ | 3.43c | 3.69c | 4.82b | 5.24c | 58191 | 3686 | 54505 | 5.20 |
| $T_6$ | 2.67d | 2.76e | 3.23c | 3.53d | 39034 | 0 | 39034 | - |
| $LSD_{0.05}$ | 0.23 | 0.20 | 0.40 | 0.35 | - | - | - | - |

* Variable Cost = Fertilizer Cost only

**CP : T.Aus-T.Aman**
**Location : Moulvibazar, Sylhet (AEZ 20)**
**Year : 2001-02**

Higher and similar grain yield of T.Aus rice was recorded from $T_3$, $T_2$ and $T_1$. Fertilizer dose from FRG '97 ($T_4$) and Farmers' practice gave identical yield and the lowest was recorded from no fertilizer treatment. In T.Aman rice, almost similar result was found from $T_2$ and $T_3$. Effect of higher levels of nutrients was evident in T.Aman rice. Regarding straw yield in T.Aus rice, higher and identical yield was recorded from $T_2$ and $T_3$. In T.Aman rice similar trend was found.

Cost and return analysis showed that the highest gross margin was obtained from $T_2$ followed by $T_3$ and $T_1$. But the highest MBCR was calculated from $T_1$ followed by $T_2$. Due to additional cost for organic manure in $T_3$, the MBCR was the lowest. STB fertilizer dose for HYG was found superior in terms of yield and economic return.

Table 41. Yield, cost and return analysis of T.Aus -T.Aman rice cropping pattern as affected by fertilizer levels at Moulvibazar MLT site, Sylhet during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | T.Aus | T.Aman | T.Aus | T.Aman | | | | |
| $T_1$ | 4.98a | 4.30b | 5.98b | 5.33b | 74875 | 4016 | 70859 | 9.00 |
| $T_2$ | 5.19a | 4.61a | 6.36a | 5.79a | 80285 | 5099 | 75186 | 8.15 |
| $T_3$ | 5.17a | 4.56a | 6.23a | 5.79a | 79616 | 8171 | 71445 | 5.00 |
| $T_4$ | 3.47b | 3.20c | 4.89c | 4.86c | 55393 | 2825 | 52568 | 5.90 |
| $T_5$ | 3.45b | 3.39c | 4.93c | 4.88c | 58769 | 3408 | 55361 | 5.88 |
| $T_6$ | 2.84c | 2.43d | 3.38d | 3.06d | 38723 | 0 | 38722 | - |
| $LSD_{0.05}$ | 0.23 | 0.21 | 0.20 | 0.26 | - | - | - | - |

* Variable Cost = Fertilizer Cost only

**Location : Jhalokati, Barisal (AEZ 13)**
**Year : 2000-01**

Significantly higher grain yield of T.Aus rice was recorded from $T_3$. In IPNS treatment ($T_3$) cowdung was applied along with inorganic fertilizers gave the highest yield. Effect of cowdung on the grain yield of T.Aus rice was evident. However, STB fertilizer doses for HYG and MYG along with FRG '97 produced statistically similar yield. Farmers practice and no fertilizer treatment also produced lowest and similar yield. In T.Aman rice, almost similar trend was observed. Response of cowdung applied in T.Aus rice was also apparent in T.Aman rice also. Cost and return analysis showed that the highest gross margin and MBCR was obtained from the treatment $T_3$.

Table 42. Yield, cost and return analysis of T.Aus -T.Aman rice cropping pattern as affected by fertilizer levels at Jhalokati MLT site, Barisal during 2002

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | T.Aus | T.Aman | T.Aus | T.Aman | | | | |
| $T_1$ | 3.52b | 3.53bc | - | - | 46330 | 4339 | 41991 | 2.49 |
| $T_2$ | 3.46b | 3.63b | - | - | 46670 | 4425 | 42245 | 2.52 |
| $T_3$ | 4.11a | 4.32a | - | - | 59510 | 5067 | 54443 | 4.73 |
| $T_4$ | 3.44b | 3.76b | - | - | 47460 | 3722 | 43738 | 3.20 |
| $T_5$ | 2.93c | 3.12cd | - | - | 39920 | 2434 | 37486 | 1.81 |
| $T_6$ | 2.70c | 2.68d | - | - | 35520 | - | 35520 | - |

* Variable Cost = Fertilizer Cost only

Price (Tk./ka): T.Aus rice= 6.00, T.Aman= 7.00, Urea= 7.00, T.S.P= 15.00, MP= 9.00, Gypsum= 4.50, Zinc oxide= 50, CD= 0.50

**CP : Mungbean-T.Aus-T.Aman**
**Location : Bhola, Barisal (AEZ 13)**
**Year : 2000-01**

Significantly the highest seed yield of Mungbean was recorded from $T_3$ where cowdung was applied along with inorganic fertilizers. However, yield did not vary between two STB fertilizer doses $T_2$ and $T_1$ (HYG and MYG) as well as FRG '97 ($T_4$). Similarly Farmers' practice ($T_5$) and Control ($T_6$) also gave identical yield. Farmers did not apply any fertilizers in Mungbean, therefore, it was same to Control treatment. In T.Aus rice, the higher grain yield was recorded from $T_3$ but it was also identical to $T_2$, $T_1$ and $T_4$. In T.Aman rice higher yield was obtained from $T_2$ followed by $T_1$. Yield did not differed significantly among the different nutrient packages except with $T_2$ and Control ($T_6$).

The highest gross margin was obtained from $T_3$ and MBCR also highest in $T_3$. Two fertilizer doses for MYG (STB & FRG '97) also gave higher MBCR due to less fertilization cost.

Table 43. Yield, cost and return analysis of Mungbean-T.Aus-T.Aman cropping pattern as affected by fertilizer levels at Bhola MLT site, Barisal during 2001-02

| Treat. | Grain yield (t/ha) | | | GR | VC | GM | MBCR |
|---|---|---|---|---|---|---|---|
| | Mungbean | T.Aus | T.Aman | | | | |
| $T_1$ | 0.76b | 3.07ab | 4.04ab | 66017 | 4767 | 61250 | 4.19 |
| $T_2$ | 0.83b | 3.17ab | 4.43a | 69923 | 6110 | 63813 | 3.91 |
| $T_3$ | 0.92a | 3.39a | 3.89b | 71543 | 4416 | 67127 | 5.78 |
| $T_4$ | 0.82b | 3.28ab | 3.70b | 63157 | 3958 | 59199 | 4.33 |
| $T_5$ | 0.66c | 2.79b | 3.67b | 55383 | 2434 | 52949 | 3.84 |
| $T_6$ | 0.67c | 2.23c | 2.77c | 46016 | 0 | 46016 | - |

* Variable Cost = Fertilizer cost only.

**Price (Tk./kg):** Urea= 7.00, TSP= 15.00, MP= 9.00, Gypsum= 4.50, CD= 0.50, Mungbean= 20.00, T.Aus= 6.00, T.Aman= 7.00

**CP : Potato-Jute**
**Location : Munshiganj (AEZ 19)**
**Year : 1999-2000 to 2001-02**

Average of three years data showed that yield of potato significantly influenced by different doses of fertilizers. The initial soil status of the experimental site (Appendix table 2) showed that except nitrogen all other nutrient elements are at optimum level to very high. Therefore, P and K were applied as maintenance dose and no sulphur was applied at all. The yield difference was mainly due to nitrogen and cowdung. The significantly highest tuber yield was recorded from IPNS ($T_3$) treatment followed by farmers' practice ($T_5$). Farmers of Munshiganj traditionally apply a very high dose of NPK in Potato which is much higher than the recommended dose. STB fertilizer dose for HYG produced 2$^{nd}$ highest yield. Fertilizer doses for MYG (STB & FRG '97) gave similar yield.

Similarly, in Jute, higher yield was recorded from $T_3$ and $T_5$ followed by $T_2$. Since the soil was initially rich with P, K and S and there should be a residual effect on the succeeding crop, therefore, only nitrogen was applied as per treatment and maintenance dose for K was applied. Farmers' also apply only nitrogen in Jute as their traditional practice. Fertilizer doses for MYG (STB & FRG '97) gave similar yield. Similar trend was found in case of stick yield. However, results over the years slightly varied. During 2000-01 and 2001-02, fiber yield of Jute did not vary significantly among the different treatments except with $T_1$ and $T_6$ but in 1999-2000, $T_3$, $T_5$ and $T_2$ gave higher and identical yield over other treatments.

Regarding cost and return analysis the highest gross margin was calculated from $T_3$ followed by $T_2$. The variable cost was highest in Farmers' practice as they apply a very high dose of fertilizer in Potato. The second highest figure was found in IPNS due to the cost of cowdung applied in Potato. Due to higher fertilizer cost, the margin was less in farmers' practice. The highest MBCR was found in $T_1$ and $T_2$. However, the gross return was higher in Farmers' practice ($T_5$) but due to higher fertilization cost the MBCR was the lowest. Based on three years of experimentation STB fertilizer dose as well as IPNS could be suggested for the cropping pattern at Munshiganj in terms of yield, economic return and long term soil fertility management.

Table 44. Effect of different nutrient management packages on the yield of crops in Potato-Jute cropping patterns at Munshiganj during 1999-2000 to 2001-02

| Treatment | 1999-2000 | | 2000-2001 | | 2001-2002 | |
|---|---|---|---|---|---|---|
| | Potato | Jute | Potato | Jute | Potato | Jute |
| | Grain yield/ fibre yield (t/ha) | | | | | |
| $T_1$ | 26.9c | 1.50b | 27.3c | 1.72b | 29.8c | 1.90b |
| $T_2$ | 33.5b | 1.84ab | 31.6b | 1.90ab | 32.1b | 2.05ab |
| $T_3$ | 34.5a | 2.02a | 33.5a | 2.0a | 33.6a | 2.44a |
| $T_4$ | 27.5c | 1.52b | 28.7c | 1.92a | 29.5c | 1.98ab |
| $T_5$ | 33.8ab | 1.97a | 32.8a | 2.03a | 33.8a | 2.40a |
| $T_6$ | 26.9c | 1.50b | 17.0d | 1.07c | 18.5d | 1.08c |
| | Stick Yield (t/ha) | | | | | |
| $T_1$ | - | 2.67b | - | 3.77b | - | 4.05b |
| $T_2$ | - | 2.95ab | - | 3.89ab | - | 4.25ab |
| $T_3$ | - | 3.58a | - | 4.06a | - | 4.52a |
| $T_4$ | - | 2.70b | - | 3.90ab | - | 4.18ab |
| $T_5$ | - | 3.53a | - | 4.28a | - | 4.45a |
| $T_6$ | - | 2.67b | - | 1.82c | - | 1.90c |

Table 45. Yield, cost and return analysis of Potato-Jute cropping pattern as affected by fertilizer levels at Munshiganj MLT site during 1999-2000 to 2001-02 (Avg. of 3 years)

| Treatment | Grain/fiber yield (t/ha) | | Stick yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Potato | Jute | Potato | Jute | | | | |
| $T_1$ | 28.0 | 1.71 | - | 3.50 | 125085 | 4086 | 121001 | 11.4 |
| $T_2$ | 32.4 | 1.93 | - | 3.70 | 146305 | 5806 | 140498 | 11.6 |
| $T_3$ | 33.9 | 2.15 | - | 4.05 | 154306 | 8362 | 145944 | 9.0 |
| $T_4$ | 28.6 | 1.81 | - | 3.59 | 128345 | 5832 | 122513 | 8.6 |
| $T_5$ | 33.5 | 2.13 | - | 4.09 | 152654 | 18360 | 134294 | 4.0 |
| $T_6$ | 17.4 | 1.07 | - | 1.85 | 78410 | 0 | 78410 | - |

* Variable Cost = Fertilizer Cost only

**CP : Chilli -T.Aman**
**Location : Lebukhali, Patuakhali (AEZ 18)**
**Year : 2001-02**

Fruit yield of Chilli did not vary appreciably among the different nutrient packages except with Farmers practice and control treatment. Response of higher levels of nutrients as well as IPNS was not observed in Chilli. However, from initial soil nutrient status it was found that the soil is deficit in NPK and therefore, a high dose of nutrients was applied. In T.Aman rice almost similar trend of result was observed in case of grain and straw yield. Cost and return analysis showed that the highest gross margin as well as MBCR was calculated from$T_4$. From one year study it was found that fertilizer dose for MYG (FRG '97) showed better performance in terms of yield and return..

Table 46. Yield, cost and return analysis of Chilli-T.Aman rice cropping pattern as affected by fertilizer levels at Lebukhali, Patuakhali during 2001-02

| Treatment | Fruit/Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Chilli | T.Aman | Chilli | T.Aman | | | | |
| $T_1$ | 1.83a | 3.84a | - | 5.67a | 90030 | 10851 | 79179 | 2.27 |
| $T_2$ | 1.78a | 3.94a | - | 5.82a | 88815 | 14138 | 74677 | 1.66 |
| $T_3$ | 1.87a | 3.98a | - | 5.86a | 92435 | 14958 | 77477 | 1.81 |
| $T_4$ | 1.84a | 3.73a | - | 5.59a | 89800 | 5630 | 84170 | 4.34 |
| $T_5$ | 1.40b | 3.31b | - | 5.13b | 71530 | 3435 | 68095 | 1.79 |
| $T_6$ | 1.34b | 2.68c | - | 4.72c | 65375 | 0 | 65375 | - |

* Variable Cost = Fertilizer Cost only

**CP : Mustard-Boro**
**Location : Manikganj (AEZ 8)**
**Year : 2001-02**

The highest seed yield of Mustard was obtained from IPNS ($T_3$) which was identical to $T_2$ and $T_4$. Farmers' practice ($T_5$) also produced identical yield with STB fertilizer dose for MYG ($T_1$). Usually farmers' apply a higher dose of N and K and they did not use any zinc or boron fertilizer. The soil was deficit with Zn and B. That's why the seed yield of Mustard was comparatively lower in Farmers' practice. In Boro rice, higher grain yield was recorded from $T_3$ followed by $T_2$. Other fertilizer packages did not vary significantly except with no fertilizer ($T_6$) treatment. Effect of higher levels of fertilizer was evident in the yield of crops. Regarding stover/straw yield more or less similar trend was observed.

From cost and return analysis it was found that the highest gross margin was obtained from IPNS treatment ($T_3$) followed by FRG '97 ($T_4$). MBCR was the highest in $T_4$. Treatment $T_1$, $T_3$ and $T_5$ gave almost similar MBCR but much lower than $T_4$.

Table 47. Yield, cost and return analysis of Mustard-Boro cropping pattern as affected by fertilizer levels at Manikganj during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | Mustard | Boro | | | | |
| $T_1$ | 0.718c | 5.72b | 1.93b | 5.14b | 57043 | 8036 | 49007 | 3.01 |
| $T_2$ | 0.885ab | 6.15ab | 2.13ab | 4.49c | 62171 | 10571 | 51600 | 2.77 |
| $T_3$ | 0.950a | 6.49a | 2.45a | 5.31b | 66101 | 10381 | 55720 | 3.20 |
| $T_4$ | 0.817abc | 5.80b | 2.01a | 5.84a | 59225 | 5528 | 53697 | 4.77 |
| $T_5$ | 0.757bc | 5.96b | 1.98b | 4.21c | 58968 | 8587 | 50381 | 3.04 |
| $T_6$ | 0.325d | 3.91c | 0.99c | 3.13d | 32845 | 0 | 32845 | - |

* Variable Cost = Fertilizer Cost only

**Location : Kaliakoir (AEZ 28)**
**Year : 2001-02**

Seed yield of Mustard varied significantly due to different fertilizer doses. Significantly higher seed yield was recorded from IPNS ($T_3$) and STB fertilizer dose for HYG ($T_2$). Fertilizer doses for MYG (STB & FRG '97) also produced similar yield. The soil was deficit in nutrients and higher level of nutrients produced higher yield over other lower levels treatments. Usually farmers' apply a higher dose of N and K and they did not use any zinc or boron fertilizer. The soil was deficit with Zn and B. That's why the seed yield of Mustard was comparatively lower in Farmers' practice. In Boro rice, significantly higher grain yield was recorded from $T_3$. Yield did not vary significantly in other treatments except with control treatment.

From cost and return analysis it was found that the highest gross margin was obtained from IPNS treatment ($T_3$) followed by FRG '97 ($T_4$) but MBCR was the highest in $T_4$ followed by $T_1$. Due to higher fertilization cost the MBCR was comparatively less in $T_2$, $T_3$ and $T_5$.

Table 48. Yield, cost and return analysis of Mustard-Boro cropping pattern as affected by fertilizer levels at Kaliakoir during 2001-02

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | Mustard | Boro | | | | |
| $T_1$ | 0.623b | 6.28b | 1.5b | 8.2b | 66660 | 7259 | 59401 | 4.24 |
| $T_2$ | 0.772a | 6.48b | 1.8a | 8.5ab | 70474 | 9847 | 60627 | 3.51 |
| $T_3$ | 0.807a | 6.77a | 1.8a | 8.9a | 73643 | 11501 | 62142 | 3.28 |
| $T_4$ | 0.595bc | 6.35b | 1.4b | 8.1b | 66709 | 5579 | 61130 | 5.52 |
| $T_5$ | 0.580c | 6.46b | 1.4b | 8.0b | 67374 | 9901 | 57473 | 3.18 |
| $T_6$ | 0.227d | 3.26c | 0.70c | 6.7c | 35896 | 0 | 35896 | - |

* Variable Cost = Fertilizer Cost only

**Location : Mymensingh (AEZ 9)**
**CP : Mustard (BARI Sarisha 9)-Boro (BRRI Dhan 29)**
**Year : 2002-03**

Seed yield of Mustard varied significantly due to different fertilizer doses. Significantly higher seed yield was recorded from IPNS ($T_3$) and STB fertilizer dose for HYG ($T_2$). Fertilizer doses for MYG (STB & FRG '97) also produced similar yield. The soil was deficit in nutrients and higher level of nutrients produced higher yield over other lower levels treatments. In Boro rice, almost similar trend was observed. Significantly higher grain yield was recorded from $T_2$ and $T_3$ treatment. However, fertilizer dose for MYG from FRG '97 gave significantly higher yield over STB fertilizer dose for MYG. Regarding stover/straw yield almost result was observed.

From cost and return analysis it was found that the highest gross margin was obtained from IPNS treatment ($T_3$) followed by STB fertilizer dose for HYG ($T_2$) and FRG'97 ($T_4$). MBCR was the highest in $T_4$ followed by $T_1$. Due to higher fertilization cost the MBCR was less in $T_2$, $T_3$ and $T_5$.

Table 49. Yield and economics of Mustard-Boro cropping pattern as affected by fertilizer levels at Mymensingh during 2002-03

| Treatment | Grain yield (t/ha) | | Straw yield (t/ha) | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR (over control) |
|---|---|---|---|---|---|---|---|---|
| | Mustard | Boro | Mustard | Boro | | | | |
| $T_1$ | 0.72b | 4.75c | 1.60b | 5.98ab | 53915 | 9011 | 44904 | 2.00 |
| $T_2$ | 0.81a | 5.83a | 1.90a | 7.10a | 64485 | 12539 | 51946 | 1.44 |
| $T_3$ | 0.94a | 5.93a | 2.05a | 7.39a | 65955 | 13266 | 56189 | 1.68 |
| $T_4$ | 0.71bc | 5.30b | 1.50b | 4.83b | 57175 | 6088 | 51087 | 2.83 |
| $T_5$ | 0.66c | 4.51d | 1.46b | 5.63ab | 50632 | 7626 | 43006 | 1.20 |
| $T_6$ | 0.42d | 3.05e | 0.77c | 4.20c | 33863 | 0 | 33863 | - |

- Variable Cost = Fertilizer Cost only

Different fertilizer doses for Mustard-Boro cropping pattern at Mymensingh

| Treatment | Mustard (N-P-K-S-Zn-B-CD) | Boro (N-P-K-S-Zn-CD) |
|---|---|---|
| $T_1$ | 67-22-25-16-1-0.5 | 98-13-45-5-1 |
| $T_2$ | 99-28-36-19-2-0.5 | 138-19-63-7-1.5 |
| $T_3$ | 84-23-21-19-2-0.5 + CD 5 t/ha | 138-19-63-7-1.5 |
| $T_4$ | 60-15-10-10-0-0-0 | 100-15-35-6-1 |
| $T_5$ | 138-38-39-0-0-0 | 115-35-26-7-0 |
| $T_6$ | 0-0-0-0 | 0-0-0-0 |

Appendix table 1. Initial soil status of the experimental site

| Location with AEZ | Land type | R/I | pH | O.C (%) | Total N (%) | K (m.eq./100g soil) | P | S | Zn | B |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ppm | | | |
| Muktagacha (9) | MHL | I | 5.56 | 1.98 | 0.171(L) | 0.085 (VL) | 7.33 (VL) | 28.3 (Opt.) | - | - |
| Phulpur (9) | MHL | I | 5.22 | 1.17 | 0.08 (VL) | 0.15 (M) | 15.3 (M) | 11.6 (L) | 1.30 (M) | 0.20 (L) |
| Netrokona (9) | MHL | I | 5.08 | 1.38 | 0.09 (L) | 0.15 (M) | 4.68 (VL) | 14.1 (L) | 1.08 (M) | 0.31 (M) |
| Satkaniya (23) | MHL | I | 5.6 | 1.95 | 0.08 (VL) | 0.08 (L) | 2.67 (VL) | 16.3 (L) | - | - |
| Narikeli (9) | MHL | I | 5.8 | 1.0 | 0.06 (VL) | 0.08 (VL) | 8.15 (L) | 12.72 (L) | 0.67 (L) | 1.39 (VH) |
| Melandah (9) | MHL | I | 4.7-5.2 | 0.75-1.28 | 0.06-0.10 (L) | 0.18-0.76 (M) | 7.99-11.32 (L) | 7.69-10.9 (L) | 1.84-5.1 (M) | 0.05-0.29 (L) |
| Sherpur (9) | MHL | I | 5.5 | 0.55-1.31 | 0.025-0.11 (VL) | 0.06-0.15 (VL) | 4.2-11.5 (L) | 6.66-15.5 (L) | 0.28-0.79 (VL) | 0.61-2.75 (VH) |
| Kendua (9) | MHL | I | 5.6 | 3.58 | 0.15 (L) | 0.12 (L) | 1.59 (VL) | 16.6 (L) | 1.08 (M) | - |
| Kishoreganj (9) | MHL | I | 5.62 | 2.83 | 0.09 (L) | 0.31 (M) | 4.11 (VL) | 21.9 (M) | 1.27 (M) | - |
| Laksam (19) | MHL | I | 5.5 | 1.80 | 0.09 (L) | 0.26 (M) | 32.0 (VH) | 15.0 (L) | 0.45 (L) | 0.52 (O) |
| Lebukhali (13) | MHL | R | 5.3 | 1.44 | 0.08 (VL) | 0.28 (Opt) | 4.4 (VL) | 33.46(Opt) | 0.34(VL) | - |
| Paba (11) | MHL | I | 8.2 | 1.53 | 0.11 (L) | 0.25 (H) | 32.0 (VH) | 78.1 (VH) | 1.35 (M) | 0.66 (M) |
| Natore (11) | MHL | R | 8.3 | - | 0.10 (L) | 0.20 (O) | 8.43 (L) | 26.71 (L) | 0.61 (L) | - |
| Barind (25) | MHL | I | 5.6 | 1.04 | 0.06 (VL0 | 0.19 (M) | 3.05 (VL) | 4.83 (L) | 2.30 (M) | 0.33 (L) |
| Munshiganj(19) | MLL | I | 4.9 | 1.97 | 0.11 (L) | 0.30 (Opt) | 29.0 (Opt) | 127.8 (VH) | 4.36 (VH) | 0.58(Opt) |
| Atkapalia (18) | MHL | R | 7.2 | 1.66 | 0.091 (L) | 0.18 (M) | 2.0 (VL) | 25.8 (O) | 0.62 (L) | 0.15 (L) |
| Feni (18) | MHL | I | 6.78 | 1.54 | 0.08 (VL) | 0.052 (VL) | 1.40 (VL) | 8.81 (VL) | 0.52 (L) | 0.25 (L) |
| Laxmipur (18) | MHL | R | 6.6 | 2.12 | 0.12 (L) | 0.19 (M) | 1.5 (VL) | 31.3 (VH) | 0.85 (L) | 0.47 (O) |
| Syedpur (3) | MHL | I | 5.8 | 2.1 | 0.09 (L) | 0.045 (VL) | 11.65 (L) | 8.52 (L) | 10.64 (L) | 0.24 (L) |
| Kushtia (11) | MHL | I | 8.1 | 2.54 | 0.15 (L) | 0.69 (VH) | 3.98 (VL) | 30.0 (O) | 0.82 (L) | 0.36 (M) |
| Shibpur (19) | MHL | I | 5.62 | 1.70 | 0.13 (L) | 0.17 (M) | 6.1 (L) | 30.8 (O) | 1.17 (M) | 0.22 (L) |
| Bagherpara (11) | MHL | I | - | - | 0.11 (L) | 0.39 (H) | 17.9 (M) | 7.34 (VL) | 3.29 (VH) | 0.4 (M) |
| Norail (11) | MHL | I | - | - | 0.11 (L) | 0.27 (M) | 1.88 (VL) | 36.0 (H) | 2.57 VH) | 0.82 (O) |
| Goyeshpur (11) | MHL | I | 7.7 | 2.06 | 0.12 (L) | 0.23 (M) | 6.5 (VL) | 5.36 (M) | 0.45 (M) | 0.33 (O) |
| Sujanagar (11) | MHL | I | 8.4 | - | 0.10 (L) | 0.39 (VH) | 1.25 (VL) | 7.52 (VL) | 1.23 (M) | 0.27 (L) |
| Ishan Gopalpur (12) | MHL | I | 7.5 | - | 0.18 (M) | 0.42 (VH) | 9.03 (L) | 18.0 (M) | - | - |
| Golapganj (20) | MHL | R | 5.20 | 1.70 | 0.08 (VL) | 0.05 (VL) | 3.25 (VL) | 22.5 (M) | 0.73 (L) | 0.36 (M) |
| Moulvibazar (20) | MHL | R | 4.74 | 1.95 | 0.09 (VL) | 0.17 (M) | 9.56 (L) | 22.3 (M) | 3.30 (VH) | 0.58 (O) |
| Bhola (13) | MHL | R | 7.1 | - | 0.57 (VL) | 0.50 (VH) | 8.8 (L) | 27.2 (O) | 1.59 (O) | 0.48 (O) |
| Jhalokati (13) | MHL | R | 6.5 | - | 0.12 (L) | 0.39 (VH) | 7.6 (L) | 50.3 (VH) | 0.93 (M) | - |
| Dumuria (13) | MHL | R | - | - | - | - | - | - | - | - |
| Kolaroa (11) | MHL | I | 8.1 | 1.88 | 0.09 (L) | 0.22 (M) | 4.80 (VL) | 13.2 (L) | 0.51 (L) | - |
| Joypurhat (25) | MHL | I | 5.8 | 1.93 | 0.09 (L) | 0.076 (L) | 3.42 (VL) | 7.35 (VL) | - | 0.12 (VL) |
| Gabtali (25) | MHL | I | 5.9 | 1.85 | 0.09 (L) | 0.125 (VL) | 6.67 (L) | 16.2 (M) | 0.76 (L) | 0.22 (L) |
| Manikganj | MLL | I | 7.15 | 1.47 | 0.09 (VL) | 0.19 (M) | 3.3 (VL) | 13.1 (L) | 0.62 (L) | 0.047 (VL) |
| Kaliakoir | MLL | I | 6.12 | 1.59 | 0.084 (VL) | 0.16 (L) | 6.63 (VL) | 15.33 (M) | 0.84 (L) | 0.23 (L0 |

Appendix table 2. Crop management practices

| Site | Cropping pattern | Variety | Seed rate (kg/ha) | Planting time | Harvesting time |
|---|---|---|---|---|---|
| Muktagacha | Mustard | Tori-7 | 10 | 4th week of Nov | 1st week of Feb |
| | Boro | BRRI Dhan 28 | 40 | 2nd week of Feb | 3rd week of May |
| | T.Aman | BRRI Dhan 33 | 40 | 4th week of July | 1st week of Nov |
| Bagherpara | Mustard | Tori-7 | 08 | 3rd week of Nov | 2nd week of Feb |
| | Boro | BRRI Dhan 28 | 40 | 3rd week of Feb | Last week of May |
| | T.Aman | BR 11 | 40 | Last week of July | 4th week of Nov |
| Gabtali | Mustard | Tori-7 | 08 | 4th week of Nov | 1st week of Feb. |
| | Boro | BRRI Dhan 28 | 50 | 2nd week of Feb | 2nd week of May |
| | T.Aman | BRRI Dhan 32 | 50 | 2nd week of July | Last week of Oct |
| Narikeli | Potato | Cardinal | 2000 | 3rd week of Nov | 1st week of March |
| | Jute | O-9897 | 8 | 3rd week of March | 3rd week of July |
| | T.Aman | BRRI Dhan 33 | 40 | Last week of July | Last week of Oct. |
| Sherpur | Wheat | Kanchan | 100 | 2nd week of Dec. | Last week of March |
| | Jute | O-9897 | 8 | 2nd week of April | Last week of July |
| | T.Aman | BRRI Dhan 32 | 50 | 1st week of Aug | Last week of Oct |
| Kishoregonj | Wheat | Kanchan | 120 | 1st week of Dec. | 3rd week of March |
| | Jute | Falgunitosa | 08 | 1st week of April | 1st week of Aug |
| | T.Aman | BR 11 | 50 | 2nd week of Aug | 4th week of Nov |
| Lebukhali | Chilli | Local | - | 2nd week of Jan. | 4th week of April |
| | T.Aman | BR-23 | 40 | Last week of Aug | Last week of Dec |
| Melandaha | Mustard | Tori 7 | 6 | 3rd week of Nov. | 1st week of Feb. |
| | Boro | BRRI Dhan 29 | 40 | 2nd week of Feb. | Last week of May |
| | T.Aman | BRRI Dhan 33 | 40 | 3rd week of July | 1st week of Nov. |
| Kendua | Boro | BR 3 | 40 | 1st week of Feb. | 3rd week of May |
| | T.Aman | BRRI Dhan 32 | 40 | Last week of July | 3rd week of Nov |
| Phulpur | Boro | BRRI Dhan 28 | 40 | Last week of Jan. | 1st week of May |
| | T.Aman | BRRI Dhan 33 | 40 | Last week of July | Last week of Oct. |
| Netrokona | Boro | Pajam | 40 | 1st week of Feb. | 2nd week of May |
| | T.Aman | BRRI Dhan 33 | 40 | Last week of July | Last week of Oct. |
| Joypurhat | Boro | BRRI Dhan 29 | 40 | Last week of Jan. | 3rd week of May |
| | T.Aman | BR 11 | 40 | Last week of July | 2nd week of Nov.. |
| Satkaniya | Boro | BR 29 | 35 | 3rd week of Jan | 2nd week of May |
| | T.Aman | BRRI Dhan 30 | 35 | Last week of July | Last week of Nov |
| Syedpur | Potato | Cardinal | 1500 | 1st week of Dec. | 2nd week of Feb. |
| | Boro | BRRI Dhan 28 | 40 | 1st week of March | 1st week of July |
| | T.Aman | BR 11 | 40 | 2nd week of July | 3rd week of Nov. |
| Feni | Boro | BRRI Dhan 29 | 40 | 1st week of Feb. | Last week of May |
| | T.Aman | BR 11 | 40 | 3rd week of July | 3rd week of Nov |
| Norail | Boro | BRRI Dhan 28 | 40 | 1st week of Feb. | 3rd week of May |
| | T.Aman | BR 11 | 40 | Last week of July | Last week of Nov |
| Paba | Potato | Cardinal | 1800 | 2nd week of Dec | Last week of March |
| | T.Aman | BRRI Dhan 39 | 40 | 2nd week of July | 1st week of Nov. |
| Natore | G.nut | DG-1 | - | 4th week of Jan. | 1st week of May |
| | T.Aman | BR 11 | 40 | 2nd week of July | 3rd week of Nov. |
| Barind | Potato | Cardinal | 1800 | Last week of Nov | 1st week of March |
| | T.Aman | BRRI Dhan 39 | 40 | 2nd week of July | 2nd week of Oct. |
| Munshiganj | Potato | Diamont | 1500 | Last week of Nov. | 1st week of March |
| | Jute | O-9897 | 10 | 2nd week of April | 2nd week of July |
| Atkapalia | G.nut | Dhaka-1 | - | 1st week of Jan. | 3rd week of May |
| | T.Aman | BRRI Dhan 32 | 40 | 1st week of Aug. | 3rd week of Nov. |
| Laxmipur | G.nut | DG-2 | - | 1st week of Jan. | Last week of May |
| | T.Aman | BRRI Dhan 32 | 40 | Last week of July | 3rd week of Nov. |
| Goyeshpur | Wheat | Kanchan | 120 | 1st week of Dec. | 3rd week of March |
| | Jute | O-9897 | 08 | 3rd week of April | 3rd week of July |
| | T.Aman | BR 11 | 50 | Last week of July | 3rd week of Nov |
| Sujanagar | Boro | BRRI Dhan 29 | 120 | 3rd week of Feb. | Last week of May |
| | T.Aman | BR 11 | 40 | Last week of July | 3rd week of Nov |
| Chandina | Potato | Diamont | 1500 | 1st week of Dec.. | 2nd week of Feb. |
| | T.Aus | BRRI Dhan 32 | 40 | Last week of April | 3rd week of July |
| | T.Aman | BR 11 | 40 | 1st week of Aug. | 3rd week of Nov. |

Appendix table 2. Contd.

| Site | Cropping pattern | Variety | Seed rate (kg/ha) | Planting time | Harvesting time |
|---|---|---|---|---|---|
| Laksam | Boro | BRRI Dhan 29 | 40 | Last week of Jan. | 2nd week of May |
| | T.Aman | BRRI Dhan 32 | 40 | 1st week of Aug. | 1st week of Dec. |
| Shibpur | Boro | BRRI Dhan 29 | 40 | Last week of Jan. | 3rd week of May |
| | T.Aman | BRRI Dhan 32 | 40 | 1st week of Aug. | 1st week of Dec. |
| Kushtia | Onion | Taherpuri | - | 1st week of Jan. | 1st week of April. |
| | T.Aus | IR 50 | 40 | 4th week of May | 1st week of Aug. |
| | T.Aman | BR 22 | 40 | 3rd week of Aug. | 2nd week of Dec. |
| Bhola | M.bean | BARI M.bean-2 | 60 | 2nd week of Feb | Mid April |
| | T.Aus | BR-14 | 40 | 2nd week of May | 3rd week of July |
| | T.Aman | BR-23 | 40 | Last week of July | Last week of Nov. |
| Jhalokati | T.Aus | Kazla | 40 | 3rd week of May | 3rd week of July |
| | T.Aman | BR-23 | 40 | Last week of July | Last week of Nov. |
| Dumuria | Sesame | Local | 8 | 1st week of March | Last week of May |
| | T.Aman | BR 23 | 40 | 3rd week of Aug. | 2nd week of Dec. |
| Kolaroa | Boro | BRRI Dhan 28 | 40 | Last week of Jan. | 1st week of May |
| | T.Aman | BR-11 | 40 | 3rd week of July | 3rd week of Nov. |
| Golapganj | T.Aus | BR 26 | 40 | 1st week of June | Mid. Aug. |
| | T.Aman | BRRI Dhan 32 | 40 | 1st week of Sept. | Last week of Nov. |
| Moulvibazar | T.Aus | BR 26 | 40 | 1st week of June | Mid. Aug. |
| | T.Aman | BRRI Dhan 32 | 40 | 1st week of Sept. | Last week of Nov. |
| Manikganj | Mustard | Tori-7 | 8 | Last week of Oct. | 3rd week of Jan. |
| | Boro | BRRI Dhan 29 | 40 | 3rd week of Feb. | 1st week of June |
| Kaliakoir | Mustard | Tori-7 | 8 | 2nd week of Nov | Last week of Jan. |
| | Boro | BRRI Dhan 29 | 40 | 2nd week of Feb. | 4th week of May |

# EFFECTS OF RICE STRAW ON THE PERFORMANCE OF BORO-FALLOW-T.AMAN RICE SYSTEM


## Abstract

An on-farm experiment was conducted at three different locations viz. Rangpur, Comilla and Khulna during 1999-2000 to 2001-02 to see the effect of Boro rice straw in corporation on the yield of T.Aman rice in Boro-T.Aman rice system. Boro rice was grown with recommended fertilizer and it was harvested at different height to remain straw in the soil. In T.Aman rice, ⅓rd and ⅔rd Boro rice straw was incorporated to the soil along with full doses as well as reduced doses of inorganic fertilizers for MYG and HYG. Only inorganic fertilizers of recommended dose for MYG and HYG and farmers' practice were also included to compare. Results showed that significant effect was observed on the yield of T.Aman rice due to incorporation of Boro rice straw in the soil along with inorganic fertilizers at Rangpur and Khulna. But at Comilla no significant effect of rice straw on T.Aman rice was observed at all.


## Introduction

Boro-T.Aman rice system is a predominant cropping pattern in Bangladesh under irrigated medium high to medium low land condition. Due to continuous practice of rice based cropping system the production seems to have reached in a stagnant position in spite of using more and more fertilizers. Use of organic matters like cowdung and farmyard manure is decreasing because of utilization as fuel materials. Further, continuous cultivation of HYV rice over the years is exhausting the soil nutrients. Thus, organic matter content and soil fertility is decreasing day by day. Recycling of organic matter is essential for maintaining soil fertility. Establishment of dhaincha or any other green manuring crop is very difficult because of heavy rainfall in the month of May. As such, alternative strategy might be incorporation of rice straw. Boro rice straw may be used as an alternate source of organic matter and may stabilize the yield of the crops under Boro-Fallow-T.Aman rice system.

Generally, Boro rice is harvested in the month of May and particularly in medium low land due to high rainfall and flash flood water farmers are forced to harvest the crop at the top remaining the straw. Thus the Boro rice straw can be utilized as organic residue to the succeeding T.Aman rice. Therefore, the complementary use of rice straw with mineral fertilizer will help to increase use efficiency of applied fertilizers and maintaining soil fertility. With this view in mind the experiment was under taken to compare rice straw and inorganic fertilizer effects with conventional practice of chemical fertilizers application on Boro-T.Aman rice system.

## Materials and Methods

The experiment was initiated from Boro season of 1999-2000 and continued to 2001-02. It was conducted at 3 different locations with 7 treatments and 6 (six) dispersed replications. The plot was divided into 7 (eight) sub-plot. The size of each unit plot was 10 m x 10 m.

In Boro rice recommended dose of fertilizers were applied in all the plots. Irrigation and other intercultural operations were done as and when necessary. Boro rice straw was harvested leaving 10, 20 and 30 cm straw from ground level. Yield and yield contributing characters of Boro rice were recorded as per requirement. Rice straw of Boro was incorporated in to the soil by ploughing. In T.Aman rice fertilizers were applied as per following treatments combinations. Seven treatments were as follows:

$T_1 = \frac{1}{3}$ Boro rice straw ( $\frac{2}{3}$ should be harvested from top) incorporation then T.Aman with $RF_2$

$T_2 = \frac{2}{3}$ Boro rice straw ( $\frac{1}{3}$ should be harvested from top) incorporation then T.Aman with $RF_2$

$T_3 = T_2$ + T.Aman with 65-22-25-20-5 kg NPKSZn/ha.
$T_4 = T_3$ + T.Aman with 50-18-16-20-5 kg NPKSZn/ha.
$T_5$= Recommended fertilizer for high yield goal ($RF_1$)
$T_6$= Recommended fertilizer for moderate yield goal ($RF_2$)
$T_7$= Farmers practices (Harvesting).

Note: $RF_1$ = 76-16-46-11-1.5 kg/ha of NPKSZn
$RF_2$ = 60-8-30-4 kg/ha of NPKS

Irrigation and other intercultural operations were done as and when necessary. Yield and yield contributing characters were recorded as per requirement and were statistically analyzed. Soil characteristics and different crop management practices followed in different sites are given in appendix I.

## Results and discussion

**Location : Rangpur**
**Year of conduction: 1999-2000 to 2001-02**

The performance of Boro rice presented in Table 1 showed that 5.54, 5.72 and 6.20 t/ha grain yield was obtained during 1999-2000, 2000-01 and 2001-02, respectively. Similarly, 6.42, 6.68 and 7.08 t/ha of straw yield was recorded during 1999-2000, 2000-01 and 2001-02, respectively. Plant height, panicle/hill, filled grain/panicle and 1000 seed weight did not vary markedly over the years.

Significantly higher grain yield of T.Aman rice was recorded from $T_5$ where Boro rice straw was incorporated traditionally (1.30 t/ha) along with 90-10-28-4 kg NPKS/ha (HYG). However, it was also identical to $T_4$ ($^2/_3$ rd rice straw i.e., 5.82 t/ha, with 50-18-16-20-5 kg NPKSZn/ha) and $T_2$ ($^2/_3$ rd rice straw i.e., 5.82 t/ha with MYG: 65 -7-20-3 kg NPKS/ha). Almost similar trend was observed over the years. These results indicated that the incorporation of $^2/_3$-rice straw along with 65-7-20-3-0 and 50-18-16-20-5 kg NPKSZn/ha had significant positive effect on the yield of T.Aman rice.

The average of three years results revealed that the maximum gross margin (GM) and marginal rate of return (MRR) were Tk. 37431/ha and 1407%, respectively and these were calculated from the treatment $T_5$. Economic return was also positive in the treatments $T_4$ and $T_2$ i.e., GM and MRR were Tk. 32646/ha & 727%, respectively in $T_4$ and Tk. 32011/ha & 337% in $T_2$. These indicated that the treatments $T_5$, $T_4$ and $T_2$ were found to be agro-economically suitable for T.Aman rice production in Boro-T.Aman rice system.

## Conclusion

From the three years results it is clear that incorporation of $^2/_3$rd boro rice straw with 50-18-16-20-5 or 65-7-20-3-0 kg NPKSZn/ha, $^2/_3$rd rice straw + 65-7-20-3 kg NPKS/ha and traditional incorporation of rice straw + 90-10-28-4 kg NPKS/ha ($T_5$) had positive effect on the productivity and profitability of T.Aman rice in Boro-T.Aman rice system.

Table 1. Performance of boro rice (BRRI Dhan 29) of the experimental plots of Nilphamari MLT site, OFRD, Rangpur during 1999-2000 to 2001-2002

| Year | Grain yield (t/ha) | Straw yield (t/ha) | Effective panicle/ hill (no.) | Filled grain/ panicle (no.) | 1000 seed wt. (g) | Plant height (cm) |
|---|---|---|---|---|---|---|
| 1999-2000 | 5.54 | 6.42 | 12.8 | 103 | 23.8 | 85 |
| 2000-2001 | 5.72 | 6.68 | 13.5 | 112 | 22.9 | 87 |
| 2001-2002 | 6.20 | 7.08 | 13.2 | 114 | 23.0 | 86 |

Table 2. Effect of boro rice straw on the yield of T.Aman rice in the Boro-T.Aman rice systems during 1999-2000, 2000-2001 and 2001-2002 at Nilphamari MLT site, OFRD, Rangpur

| Treatment | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-00 | 2000-01 | 2001-02 | Mean |
| $T_1$ | 4.55cd | 4.69c | 4.72d | 4.65 |
| $T_2$ | 5.00abc | 5.14abc | 5.43abc | 5.19 |
| $T_3$ | 4.86bc | 5.00abc | 5.10bcd | 4.99 |
| $T_4$ | 5.21ab | 5.37ab | 5.53ab | 5.37 |
| $T_5$ | 5.46a | 5.58a | 5.62a | 5.55 |
| $T_6$ | 4.24d | 4.56c | 4.61d | 4.47 |
| $T_7$ | 4.78bc | 4.90bc | 4.93cd | 4.87 |
| CV (%) | 7.70 | 9.7 | 8.0 | - |
| | Straw Yield (t/ha) | | | |
| $T_1$ | 5.46cd | 5.65bc | 5.74cd | 5.62 |
| $T_2$ | 6.08b | 6.28ab | 6.36abc | 6.24 |
| $T_3$ | 5.83bc | 6.09bc | 6.13bcd | 6.02 |
| $T_4$ | 6.19ab | 6.40ab | 6.50ab | 6.36 |
| $T_5$ | 6.66a | 6.92a | 6.98a | 6.85 |
| $T_6$ | 5.23d | 5.49c | 5.55d | 5.42 |
| $T_7$ | 6.03b | 6.35ab | 6.40abc | 6.26 |
| CV (%) | 7.4 | 9.2 | 8.5 | - |

Mean followed by the common letter(s) are not significantly different at the 5% level by DMRT.

Table 3. Effect of boro rice straw on the economy of T.Aman rice in Boro-T.Aman rice system at Nilphamari MLT site, OFRD, Rangpur during 1999-2000 and 2000-01

| Treatment | Gross return (Tk./ha) | Variable cost (Tk./ha) | Gross margin (Tk./ha) | BCR | MBCR (over $T_6$) | MRR (%) |
|---|---|---|---|---|---|---|
| | Year: 1999-2000 | | | | | |
| $T_1$ | 38730 | 10486 | 28244 | 3.69 | 1.75 | (-) 909 |
| $T_2$ | 43040 | 11461 | 31579 | 3.76 | 2.92 | 330 |
| $T_3$ | 41795 | 12270 | 29525 | 3.41 | 1.73 | (-) 256 |
| $T_4$ | 44775 | 12663 | 32112 | 3.54 | 2.40 | 658 |
| $T_5$ | 47010 | 9877 | 37133 | 4.76 | 16.34 | 1534 |
| $T_6$ | 36535 | 9236 | 27299 | 3.96 | - | - |
| $T_7$ | 41255 | 10129 | 31126 | 4.07 | 5.28 | (-) 2383 |
| | Year: 2000-2001 | | | | | |
| $T_1$ | 40345 | 11316 | 29029 | 3.57 | 0.94 | (-) 1127 |
| $T_2$ | 44260 | 12263 | 31997 | 3.61 | 2.08 | 313 |
| $T_3$ | 43045 | 12742 | 30303 | 3.38 | 1.37 | (-) 354 |
| $T_4$ | 46160 | 13078 | 33082 | 3.53 | 2.14 | 827 |
| $T_5$ | 48100 | 10233 | 37867 | 4.70 | 14.90 | 1390 |
| $T_6$ | 38725 | 9604 | 29121 | 4.03 | - | - |
| $T_7$ | 42375 | 10522 | 31853 | 4.02 | 3.97 | (-) 2081 |

Table 3. contd.

| Treatment | Gross return (Tk./ha) | Variable cost (Tk./ha) | Gross margin (Tk./ha) | BCR | MBCR (over $T_6$) | MRR (%) |
|---|---|---|---|---|---|---|
| | | | Year: 2001-2002 | | | |
| $T_1$ | 40095 | 11179 | 28916 | 3.59 | 1.23 | (-) 645 |
| $T_2$ | 44640 | 12184 | 32456 | 3.66 | 2.66 | 352 |
| $T_3$ | 42930 | 13002 | 29928 | 3.30 | 1.42 | (-) 309 |
| $T_4$ | 46140 | 13397 | 32743 | 3.44 | 2.17 | 713 |
| $T_5$ | 47825 | 10532 | 37293 | 4.54 | 14.03 | 1303 |
| $T_6$ | 38470 | 9865 | 28605 | 3.90 | - | - |
| $T_7$ | 42090 | 10813 | 31277 | 3.89 | 3.82 | (-) 2141 |
| | | | Mean of 3 Years | | | |
| $T_1$ | 39724 | 10994 | 28730 | 3.61 | 1.27 | (-) 531 |
| $T_2$ | 43980 | 11969 | 32011 | 3.67 | 2.53 | 337 |
| $T_3$ | 42590 | 12671 | 29919 | 3.36 | 1.51 | (-) 298 |
| $T_4$ | 45692 | 13046 | 32646 | 3.50 | 2.24 | 727 |
| $T_5$ | 47645 | 10214 | 37431 | 4.66 | 15.07 | 1407 |
| $T_6$ | 37910 | 9568 | 28341 | 3.96 | - | - |
| $T_7$ | 41907 | 10488 | 31419 | 4.00 | 4.34 | (-) 2194 |

Price (Tk/kg)

| Urea | TSP | MP | Gypsum | Zinc Sulphate | Rice seed | Rice grain | Rice straw |
|---|---|---|---|---|---|---|---|
| 5.60 | 12.40 | 8.40 | 3.00 | 35.00 | 12.00 | 8.00 | 0.50 |
| 5.70 | 13.14 | 8.70 | 2.75 | 35.00 | 14.50 | 8.00 | 0.50 |

**Location : Comilla**
**Year of conduction: 2001-02**

Boro: Results revealed that grain yield of Boro rice did not vary significantly among the treatments (Table-1). Similarly, plant height, yield attributes and straw yield was also identical among the treatments. Effect of rice straw incorporation in the soil was not observed following Boro rice.

T.Aman: Performance of T.Aman rice after incorporation of boro rice straw with different rates of fertilizer had been presented in table 2. The result showed no significant effect was observed among the treatments. Incorporation of Boro rice straw did not have any significant response on the yield of T.Aman rice. However, the treatments where Boro rice straw was incorporated along with inorganic fertilizers gave comparatively higher yield over the treatments received only inorganic fertilizers. Growth and yield contributing characters and straw yield almost follow the similar trend.

Cost and return analysis showed that the higher gross margin was obtained from treatment $T_2$ followed by $T_4$ where 2/3$^{rd}$ Boro rice straw was incorporated along with inorganic fertilizers

## Conclusion

Incorporation of Boro rice straw along with the chemical fertilizer influenced the grain and straw yield of succeeding T.Aman crop to some extent. Further study should be done with some soil physical parameters which might be improved by the addition of rice straw.

Table 4. Yield and yield contributing characters of Boro under Boro - T.Aman cropping pattern at Comilla sadar during 2001-02

| Treatment (N-P-K-S kg/ha) | Plant height (cm) | Effective tiller/ hill | Grain/ Panicle | 1000-grain wt. (g) | Straw wt. (t/ha) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| $T_1$= 95-20-40-10 | 78.32 | 15.45 | 98.22 | 23.00 | 8.30 | 6.88 |
| $T_2$= 95-20-40-10 | 78.37 | 15.10 | 100.42 | 23.20 | 8.41 | 6.92 |
| $T_3$= 95-20-40-10 | 78.30 | 15.55 | 101.35 | 23.35 | 8.22 | 6.74 |
| $T_4$= 95-20-40-10 | 79.17 | 14.85 | 102.67 | 23.52 | 7.88 | 6.52 |
| $T_5$= 95-20-40-10 | 80.23 | 14.98 | 97.17 | 23.32 | 8.53 | 6.98 |
| $T_6$= 95-20-40-10 | 80.03 | 15.56 | 98.20 | 23.15 | 8.04 | 6.58 |
| $T_7$= 95-20-40-10 | 79.35 | 14.32 | 102.60 | 23.25 | 8.12 | 6.78 |
| $T_8$= 95-20-40-10 | 80.32 | 14.02 | 102.05 | 23.52 | 7.86 | 6.53 |
| LSD | NS | NS | NS | NS | NS | NS |
| CV% | 10.52 | 13.86 | 9.37 | 7.25 | 12.14 | 10.11 |

Table 5. Yield and yield contributing characters of T.Aman under Boro-T.Aman cropping pattern at Comilla sadar during 2001-02

| Treatment | Plant height (cm) | Effective tiller/ hill | Panicle length (cm) | Grain/ panicle | 1000-Grain wt.(g) | Straw wt. (t/ha) | Yield (t/ha) |
|---|---|---|---|---|---|---|---|
| $T_1$= 54-19-21-4.5+ $^1$/3rd RS | 101.17 | 11.75 | 22.54 | 161.27 | 21.88 | 8.11 | 5.70 |
| $T_2$= 54-19-21-4.5+ $^2$/3rd SR | 99.40 | 12.72 | 22.65 | 159.75 | 22.13 | 6.97 | 5.98 |
| $T_3$= 65-22-25-20-+ $^1$/3rd RS | 102.12 | 12.70 | 22.32 | 168.63 | 22.22 | 7.49 | 5.65 |
| $T_4$= 50-18-16-20+ $^2$/3rd RS | 103.20 | 12.22 | 23.34 | 166.72 | 22.21 | 8.05 | 5.75 |
| $T_5$= 74-23-27-6.3 | 99.17 | 12.50 | 22.48 | 165.84 | 22.35 | 7.78 | 5.56 |
| $T_6$= 54-19-21-4.5 | 101.20 | 11.57 | 23.36 | 167.75 | 22.37 | 7.62 | 5.44 |
| $T_7$= 90-37-32 | 100.80 | 12.22 | 23.25 | 158.45 | 22.78 | 7.24 | 5.17 |
| LSD | NS | NS | NS | NS | NS | NS | NS |
| CV (%) | 8.88 | 13.13 | 11.48 | 14.55 | 7.61 | 10.88 | 12.98 |

Table 6. Cost and return analysis of the cropping pattern Boro- T.Aman rice system at Comilla sadar during 2000-01

| Treatment | Yield (t/ha) | | Variable cost(tk/ha) | Gross return (t/ha) | Gross margin (tk/ha) |
|---|---|---|---|---|---|
| | Boro | T.Aman | | | |
| $T_1$ | 6.92 | 5.70 | 6503 | 88340 | 81768 |
| $T_2$ | 6.74 | 5.98 | 6572 | 89040 | 82468 |
| $T_3$ | 6.52 | 5.65 | 7331 | 84000 | 76669 |
| $T_4$ | 6.98 | 5.75 | 6740 | 89110 | 82370 |
| $T_5$ | 6.58 | 5.56 | 7946 | 84980 | 77034 |
| $T_6$ | 6.78 | 5.44 | 6434 | 85540 | 79106 |
| $T_7$ | 6.53 | 5.17 | 12541 | 81900 | 69359 |

- Variable Cost = Fertilizer cost only.

Price: T.Aus rice @ Tk. 7.00 /kg, T.Aman @ Tk. 7.00 /kg, Rice straw @ Tk. 1.00 /kg
Urea @ Tk. 6.00 /kg, T.S.P @ Tk.15.00 /kg, M P @ Tk.9.00 /kg, Gypsum @ Tk.4.00 /kg,

**Location : Kolaroa**
**Year of conduction: 2001-02**

The performance of Boro rice showed that 5.52 t/ha of grain and 6.60 t/ha of straw yield of Boro rice was obtained from $T_6$ (Table 1). The effects of treatment on the yield of T.Aman rice have been shown in (Table 2). Significantly higher yield was observed in $T_7$ followed by $T_5$ & $T_2$. These results indicated that the incorporation of 2/3$^{rd}$ rice straw along with 70-6-20-4 kg/ha NPKSZn had significant effect on the yield of T.Aman rice in comparison to only inorganic fertilizers.

The effect of rice straw on the economic performance of T.Aman has been shown in Table-3. The highest gross margin and benefit cost ratio was obtained from $T_5$ followed by $T_2$. However this is the result of first year. The study will be continued for next year for concrete recommendation.

Table 7. Performance of Boro rice and rice straw incorporated into the soil before T.Aman transplanting under Boro-T.Aman cropping pattern at Kalaroa MLT site during 2001-02

| Treatment | Boro rice (t/ha) | | Before T.Aman transplanting |
|---|---|---|---|
| | Grain yield | Straw yield | Boro rice straw incorporated (t/ha) |
| $T_1$ | 5.25 | 5.50 | 1.86 |
| $T_2$ | 5.52 | 6.13 | 3.60 |
| $T_3$ | 5.26 | 5.63 | 1.90 |
| $T_4$ | 5.42 | 6.38 | 3.61 |
| $T_5$ | 5.50 | 6.50 | 1.09 |
| $T_6$ | 5.52 | 6.60 | 1.09 |
| $T_7$ | 5.31 | 6.50 | 1.09 |
| Average | 5.40 | 6.18 | 2.03 |

Table 8. Effect of Boro rice straw and fertilizer on yield and yield attributes of T.Aman rice under Boro-T.Aman cropping pattern at Kalaroa MLT site, 2001-02

| Treatment | Plant height (cm) | Filled grain /panicle (no.) | 1000 grain weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|
| $T_1$ = 1/3 boro rice straw + 70-6-20-4-0kg/ha NPKSZn | 104.20a | 99.58bc | 21.97d | 4.17b | 4.72a |
| $T_2$ = 2/3 boro rice straw + 70-6-20-4-0 kg/ha NPKSZn | 103.00ab | 104.67b | 23.22bcd | 4.77a | 5.12a |
| $T_3$ = 1/3 boro rice straw + 65-22-25-20-5 kg/ha NPKSZn | 99.87bc | 95.75c | 22.34cd | 4.02b | 4.72a |
| $T_4$ = 2/3 boro rice straw + 50-18-16-20-5 kg/ha NPKSZn | 99.92bc | 99.67bc | 24.31abc | 4.27b | 4.77a |
| $T_5$ = HYG ($RF_1$) 91-7.8-26-5.2-0 kg/ha NPKSZn | 98.67c | 101.37bc | 25.31ab | 4.82a | 5.15a |
| $T_6$ = MYG ($RF_2$) 70-6-20-4-0 kg/ha NPKSZn | 99.97bc | 99.02bc | 24.81ab | 4.02b | 4.55a |
| $T_7$ = (FP) 135-30-37.5-0-5.4 kg/ha NPKSZn | 105.15a | 111.72a | 26.19a | 4.97a | 5.22a |
| CV (%) | 2.31 | 4.14 | 5.67 | 5.23 | 9.33 |

Means followed by common letters are statistically similar at 5% level.

Table 9. Cost and return analysis of the cropping pattern Boro- T.Aman rice system at Kalaroa during 2001-02

| Treatment | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|
| $T_1$ | 31,550 | 9,819 | 21,731 | 3.21 |
| $T_2$ | 35,950 | 10,769 | 25,181 | 3.39 |
| $T_3$ | 30,500 | 12,429 | 18,071 | 2.45 |
| $T_4$ | 32,275 | 12,775 | 19,500 | 2.53 |
| $T_5$ | 36,315 | 9,857 | 26,458 | 3.68 |
| $T_6$ | 30,415 | 9,377 | 21,038 | 3.24 |
| $T_7$ | 37,400 | 13,377 | 24,023 | 2.80 |

**Price** (Tk/kg): Urea= 6.00, Gypsum= 4.00, TSP= 14.00, MP= 10.00, $ZnSO_4$= 80.00
Rice grain= 7.00, Rice straw= 0.50

Appendix table 1. Crop management practices

| Site | Crop | Variety | Seed rate (kg/ha) | Planting time | Harvesting time |
|---|---|---|---|---|---|
| Nilphamari | Boro | BRRI Dhan 28 | 40 | 1st week of Feb | Last week of May |
| | T.Aman | BR 11 | 40 | 3rd week of July | 4th week of Nov |
| Kolaroa | Boro | BRRI Dhan 29 | 40 | Last week of Jan. | Last week of April |
| | T.Aman | BR 11 | 40 | 3rd week of July | 3rd week of Nov. |
| Comilla | Boro | BRRI Dhan 29 | 4040 | 1st week of Feb | 2nd week of June |
| | T.Aman | BRRI Dhan 33 | | 2nd week of Aug | 2nd week of Nov |

Appendix table 2. Initial soil nutrient status of Rangpur

| CEC | $P^H$ | OM | N | Ca | Mg | K | P | S | Zn | B |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (%) | (%) | me g/100g soil | | | Microgram/g soil | | | |
| 0.19 | 5.3 | 1.58 | 0.08<br>V. Low | 2.5<br>Low | 0.6<br>Low | 0.10<br>Low | 15.2<br>Med | 16.5<br>Med | 1.20<br>Med | 0.21<br>Low |

Appendix table 3. Initial soil analysis results of Kalaroa MLT site

| Nutrient | Soil test value | Soil test interpretation |
|---|---|---|
| $P^H$ | 8.1 | Slightly alkaline |
| Organic matter (%) | 1.88 | Medium |
| EC (mmhos/cm) | 0.66 | Non saline |
| Total N (%) | 0.092 | Low |
| Available P (ppm) | 4.80 | Very low |
| K (meq./100g) | 0.22 | Medium |
| S (ppm) | 13.21 | Low |
| Zn (ppm) | 0.51 | Low |

# SUSTAINING CROP PRODUCTIVITY AND SOIL HEALTH THROUGH INTEGRATED FERTILIZER MANAGEMENT


## Abstract

The experiment was conducted at Lebukhali FSRD site of OFRD, BARI, Patuakhali during 2001-02 to observe the effect of different nutrient management packages on soil fertility and productivity of Mungbean-T.Aus-T.Aman cropping pattern. Four different nutrient management packages (crop residues + CD @ 10 t/ha + estimated inorganic fertilizers, crop residues + CD @ 5 t/ha + estimated inorganic fertilizers, crop residues + estimated inorganic fertilizers and only inorganic fertilizers at recommended rate) along with Farmers' practice and no fertilizer control treatment were tested. Grain yield of crops did not vary significantly among the different nutrient packages except with Farmers' practice and no fertilizer treatment. Different IPNS based nutrient management produced identical yield to recommended inorganic fertilizer dose (FRG'97). Regarding cost and return analysis, the highest gross margin as well as MBCR was calculated from $T_3$ where only crop residues were incorporated along with estimated inorganic fertilizers.


## Introduction

Soil of tidal Ganges Floodplain (AEZ-13) is non-calcareous and silty clay to heavy clay in texture, slightly acidic in dry season to slightly alkaline in wet season ($p^H$ 5.5-7.4). Generally fertility is poor, soil organic matter content is about 1% and native soil nitrogen and phosphorus content is low to very low. Drainage is very poor. Drying of soil results in very hard consistence difficult to plough for rabi crop cultivation with weak draft animal as available in the locality and type is medium high land to medium low land flooded twice daily usually from May to October. T.Aus, T.Aman and rabi crops (area coverage 25%) like Mungbean, Khesari, Cowpea, Chili are main crops. Farmers use very low amount of inorganic fertilizer. It is necessary to study the long term effect of integrated fertilizer management practices on major cropping pattern for sustaining soil fertility, crop productivity and for improvement of soil health. With this point of view Mungbean-T.Aus-T.Aman cropping pattern was selected as brown mungbean plant is a good source of organic matter that can be easily incorporated in soil without any extra cost. Farmers usually did not apply any organic manure in their traditional cultivation practice. Integrated nutrient management with organic and inorganic fertilizers will be very useful to improve and maintain soil fertility for sustainable crop production. Keeping this view in mind the experiment was designed with following objectives-

- To increase crop productivity.
- To improve soil health.
- To improve soil physical condition.

## Materials and Methods

The experiment was initiated under rainfed condition at FSRD site, Lebukhali, Patuakhali in rabi season of 2001-2002, with Mungbean in Mungbean-T.Aus-T.Aman cropping pattern. Six treatments of fertilizer management with 5 dispersed replications were set up in RCB design. Treatments are given in table 1. A seed of BARI Mung-2 were sown at the rate of 30 kg/ha in line sowing of spacing 30 cm. Seeds were sown on 6 February 2002. Crop was infested by pod borer at ripening stage. Insecticide, Malathion was sprayed 2 times at 7 days interval. Pods were harvested two times first on April15-20, and finally on May 3-6, 2002. After then plants were incorporated in soil at the time of land preparation before T.Aus. For T.Aus fertilizer dose was estimated by deducting the amount of nutrient element that was added by mungbean plants. In the same way straw of T.Aus was incorporated in the soil during land preparation for T.Aman and fertilizer dose for T.Aman was estimated by deducting the amount of nutrient element that was added by T.Aus straw. Fertilizer doses were estimated on the basis of FRG'97 recommendation. Variety of T.Aus and T.Aman was BRRI Dhan-27 and BR-23, respectively. At the beginning of the experiment soil sample was collected for chemical analysis and sent to SRDI regional laboratory, Khulna. Data was collected from plants sample.

Table 1. Treatments for fertilizer management

| Treatment | Estimated chemical fertilizer | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mungbean | | | T.Aus | | | T.Aman | | |
| | N | P | K | N | P | K | N | P | K |
| $T_1$= Crop residues + Cowdung (10 t/ha) + Estimated chemical fertilizer | 0 | 0 | 0 | 20 | 4 | 20 | 12 | 2 | 0 |
| $T_2$= Crop residues+ Cowdung (5 t/ha) + Estimated chemical fertilizer | 0 | 3 | 0 | 20 | 4 | 20 | 12 | 2 | 0 |
| $T_3$= Crop residues+ Estimated chemical fertilizer | 12 | 8 | 8 | 20 | 4 | 20 | 12 | 2 | 0 |
| $T_4$= Recommended fertilizer dose (FRG '97) | 12 | 8 | 8 | 35 | 4 | 20 | 30 | 3 | 20 |
| $T_5$= Farmers' practice (Mungbean: CD 3 t/ha) | 0 | 0 | 0 | 60 | 0 | 0 | 40 | 0 | 0 |
| $T_6$= Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

To estimate the requirement of chemical fertilizer following information was followed.
Cowdung : 3-1-3 kg N-P-K per ton for following crop.
Crop residues (Mungbean) : 6 kg N per ton dry biomass to succeeding T.Aus.
Crop residues (T.Aus) : 2-0.5-8 kg N-P-K per ton dry biomass to succeeding T.Aman

## Results and discussion

Grain yield of Mungbean did not vary significantly among the treatments except with Farmers' practice ($T_5$) and no fertilizer treatment ($T_6$). As Mungbean was the first crop of the cycle therefore, no crop residues were added. Application of only cowdung @ 10 t/ha produced identical yield to only inorganic fertilizers at recommended rate. In Farmers' practice, farmers' traditionally use 3 t/ha of cowdung in mungbean and no inorganic fertilizers were applied at all. But the yield was significantly lower than recommended fertilizer dose as well as other organic and IPNS treatment. In T.Aus and T.Aman rice similar trend was observed. Grain yield did not very significantly among the different treatments except with Farmers' practice and no fertilizer treatment. Identical yield was recorded from only inorganic fertilizer at recommended rate and IPNS based fertilizer doses. Almost similar result was found in case of straw/stover yield of crops. Farmers' apply only nitrogenous fertilizer in T.Aus and T.Aman @ 40 and 60 kg/ha, respectively. They did not apply any PKS fertilizers; therefore, yield was lower than other fertilizer doses.

Regarding cost and return analysis, the highest gross margin as well as MBCR was obtained from treatment $T_3$ where only crop residues were incorporated along with estimated inorganic fertilizers. Incorporation of crop residues of Mungbean and T.Aus could reduce the inorganic fertilizer and thereby reduced cost of production. However, it was the result of first year, therefore, the experiment should be continued for another two years to see the effect of different treatments on soil physical properties as well as soil fertility and to draw a conclusion in this regard.

Table 2. Yield and economics of Mungbean-T.Aus-T.Aman cropping pattern as affected by different fertilizer doses at Lebukhali, Patuakhali during 2001-02

| Treatment | Grain yield (kg/ha) | | | Straw yield (kg/ha) | | | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR over control |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mungbean | T.Aus | T.Aman | Mungbean | T.Aus | T.Aman | | | | |
| $T_1$ | 1224a | 4121ab | 4565a | 3054 | 4520 | 4658 | 74800 | 43510 | 31290 | 6.28 |
| $T_2$ | 1211a | 4146a | 4581a | 3005 | 4492 | 4620 | 74706 | 41235 | 33471 | 7.33 |
| $T_3$ | 1196a | 4026ab | 4630a | 2980 | 4328 | 4682 | 74170 | 39420 | 34750 | 13.19 |
| $T_4$ | 1183a | 4067ab | 4505a | 2950 | 4265 | 4565 | 73305 | 40327 | 32978 | 9.03 |
| $T_5$ | 1080b | 3205c | 3150b | 2680 | 3724 | 3466 | 56525 | 38542 | 17983 | 8.53 |
| $T_6$ | 760c | 2662d | 2580c | 1870 | 3452 | 2850 | 45415 | 37240 | 8175 | - |
| CV (%) | 8.60 | 6.31 | 12.27 | - | - | - | - | - | - | - |

**Input** (Tk./kg): Urea = 6.00, TSP = 15.00, MP = 10.00, Mungbean seed = 40.00, T.Aus seed = 15.00, T.Aman seed = 15.00
**Output** (Tk./kg): Mungbean= 20.00, T.Aus rice= 5.00, T.Aman rice= 6.00, Rice straw = 0.50

Appendix Table 1. Effect of different nutrient management packages on yield and yield contributing characters in Mungbean under CP Mungbean-T.Aus-T.Aman during 2001-02 at FSRD site, Lebukhali, Patuakhali

| Treatment | Plant pop./m$^2$ | Plant height (cm) | No. of pods/ plant | No. of seeds/ pod | 1000-grain wt. (gm) | Grain yield (kg/ha) | Stover yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 39 | 51 | 12 | 9.0 | 31.0 | 1224a | 3054 |
| $T_2$ | 38 | 49 | 12 | 9.0 | 31.0 | 1211a | 3005 |
| $T_3$ | 38 | 50 | 12 | 9.0 | 31.0 | 1196a | 2980 |
| $T_4$ | 39 | 48 | 12 | 9.0 | 30.5 | 1183a | 2950 |
| $T_5$ | 39 | 47 | 11 | 9.0 | 30.0 | 1080b | 2680 |
| $T_6$ | 38 | 43 | 10 | 7.5 | 29.0 | 760c | 1870 |
| CV (%) | | | | | | 8.6 | |

Appendix Table 2. Effect of different nutrient management packages on yield and yield contributing characters in T.Aus under CP Mungbean-T.Aus-T.Aman during 2002 at FSRD site, Lebukhali, Patuakhali.

| Treatment | Panicle/m$^2$ | Filled grain /Panicle | Unfilled grain/panicle | 1000-grain weight (gm) | Grain yield (kg/ha) | Straw yield (kg/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 150a | 96a | 8a | 28.8a | 4121ab | 4520 |
| $T_2$ | 149a | 97a | 6 | 28.8a | 4146a | 4492 |
| $T_3$ | 144a | 95a | 6 | 28.8a | 4026ab | 4328 |
| $T_4$ | 147a | 96a | 7 | 28.8a | 4067ab | 4265 |
| $T_5$ | 133b | 84b | 10 | 28.2b | 3205c | 3724 |
| $T_6$ | 128c | 74c | 12 | 28.0b | 2662d | 3452 |
| CV(%) | 4.05 | 7.43 | | 1.64 | 6.31 | |

Appendix Table 3. Effect of different nutrient management packages on yield and yield contributing characters in **T.Aman** under CP Mungbean-T.Aus-T.Aman during 2002 at FSRD site, Lebukhali, Patuakhali

| Treatment | Panicle/ m$^2$ | Filled grain /panicle | Unfilled grain/ panicle | 1000-grain weight (gm) | Grain yield (kg/ha) | Straw yield (kg/ha) |
|---|---|---|---|---|---|---|
| $T_1$ | 176a | 96a | 13 | 27.4a | 4565a | 4658 |
| $T_2$ | 175a | 96a | 11 | 27.4a | 4581a | 4620 |
| $T_3$ | 177a | 97a | 13 | 27.2a | 4630a | 4682 |
| $T_4$ | 173a | 96a | 12 | 27.3a | 4505a | 4565 |
| $T_5$ | 161b | 76b | 15 | 26.4b | 3150b | 3466 |
| $T_6$ | 154b | 67c | 17 | 25.7c | 2580c | 2850 |
| CV%) | 2.77 | 4.59 | | 0.52 | 12.27 | |

**Subproject: Crop Response to Added Nutrients**

## RESPONSE OF CROPS GROWN IN DIFFERENT CROPPING PATTERNS AND ENVIRONMENTS TO ADDED FERTILIZER NUTRIENTS


### Abstract

The experiment was conducted at 27 different locations across the country with 8 dominant cropping patterns during 1999-2000 to 2001-02 to find out an optimum fertilizer dose for the crops grown in different cropping pattern & response of crops to NPKS. Four different levels of NPKS, viz. 0, MYG, HYG and HYG x 1.3 were tested. Results showed that a marked response on the yield of crops to N was evident irrespective of locations. Even in some locations the response was linear. A considerable response to P was also observed in most of the locations, particularly in P deficient soils. But response to K and S was not clear in some of the locations. From the yield data a response curve was drawn and optimum fertilizer dose for the crops were find out.


### Introduction

Crops grown in different cropping patterns and environment responded differently to mineral fertilizer nutrients. The nature of response may vary over time. In the past, most of the fertilizer recommendations were individual crop basis. But there some residual effects of some nutrient elements particularly PKS and Zn are found in the succeeding crops. In Bangladesh different crops are grown in different cropping patterns under different agro-climatic condition. Recently BARC developed a national fertilizer recommendation guide '97 with fertilizer recommendation for different crops based on AEZ that needs to further update and verified for different dominant cropping patterns at different environments. Therefore, it is very important to verify and update the present recommendation of BARC FRG'97 for major crops under different agro-ecological condition.

### Objective

- To determine optimum and economic dose of fertilizer nutrients for major crops grown in different environments.

### Materials and Methods

The experiment on seven dominant cropping patterns was conducted during 1999-2000 to 2001-02 at different AEZs to determine optimum and economic dose of fertilizer nutrients for major crops grown in different environments. Details about site characteristics and crop management are given in appendix table 1 & 2, respectively. The experiment was laid out in RCB design with six replications across the field. Four different levels of NPK and S for different crops grown in different cropping patterns were tested all over the country. The treatment concept was as follows-

| Levels | N | P | K | S |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | MYG | MYG | MYG | MYG |
| 2 | HYG | HYG | HYG | HYG |
| 3 | HYG x 1.3 | HYG x 1.3 | HYG x 1.3 | HYG x 1.3 |

**Different cropping patterns tested in different locations**

| Cropping pattern | Locations |
|---|---|
| Mustard-Boro-T.Aman | Melandah, Narikeli, Muktagacha, Bagherpara |
| Boro-T.Aman | Phulpur, Netrakona, Kishoreganj, Kendua, Ishan Gopalpur, Kolaroa, Hathazari, Syedpur, Polashbari, Nilphamari, Feni, Norail |
| Wheat-Jute-T.Aman | Sherpur |
| Wheat-T.Aman | Goyeshpur, Barind |
| Groundnut-T.Aman | Laxmipur, Atkapalia |
| Onion-B.Aman | Baliakandi |
| T.Aus-T.Aman | Golapganj, Moulvibazar, Jhalokati |
| Chilli-T.Aman | Lebukhali, Patuakhali |

## Results and Discussion

**Cropping pattern : Mustard - Boro - T.Aman**
**Location : Bagherpara, Jessore**
**Year of establishment : 1999-2000 to 2001-02**

### Mustard

In Mustard, response of nitrogen towards the seed yield was observed. Seed yield increased sharply up to 60 kg N/ha and after that level the trend was increasing but rate was slow and yield increase up to the highest level of N (100 kg/ha). Similarly, phosphorus and sulphur also showed some response towards the yield. Yields increased markedly up to 11 kg P/ha and then slowly increase up to the highest level 25 kg/ha. Sulphur also showed some response and yield increase markedly up to 24 kg/ha. However, response of K was not evident.

### Boro rice

Grain yield of rice increased with the increase of nitrogen and the trend was linear. Highest yield was recorded from the highest level of N. However, grain yield increase sharply up to the application of N @ 130 kg/ha and thereafter the trend was not so sharp. Similar trend was observed in case of phosphorus and sulphur and the trend was linear. Highest grain yield was recorded from the highest level of P and S (10 kg/ha and 24 kg/ha).

### T.Aman rice

Response of nitrogen was found on the yield of T.Aman rice. Yield increased linearly with the increase of nitrogen. Similarly, response to P was linear and the highest yield was recorded from the highest level of P. But response of sulphur in T.Aman rice was not evident.

From the average of three years data a response curve was drawn.

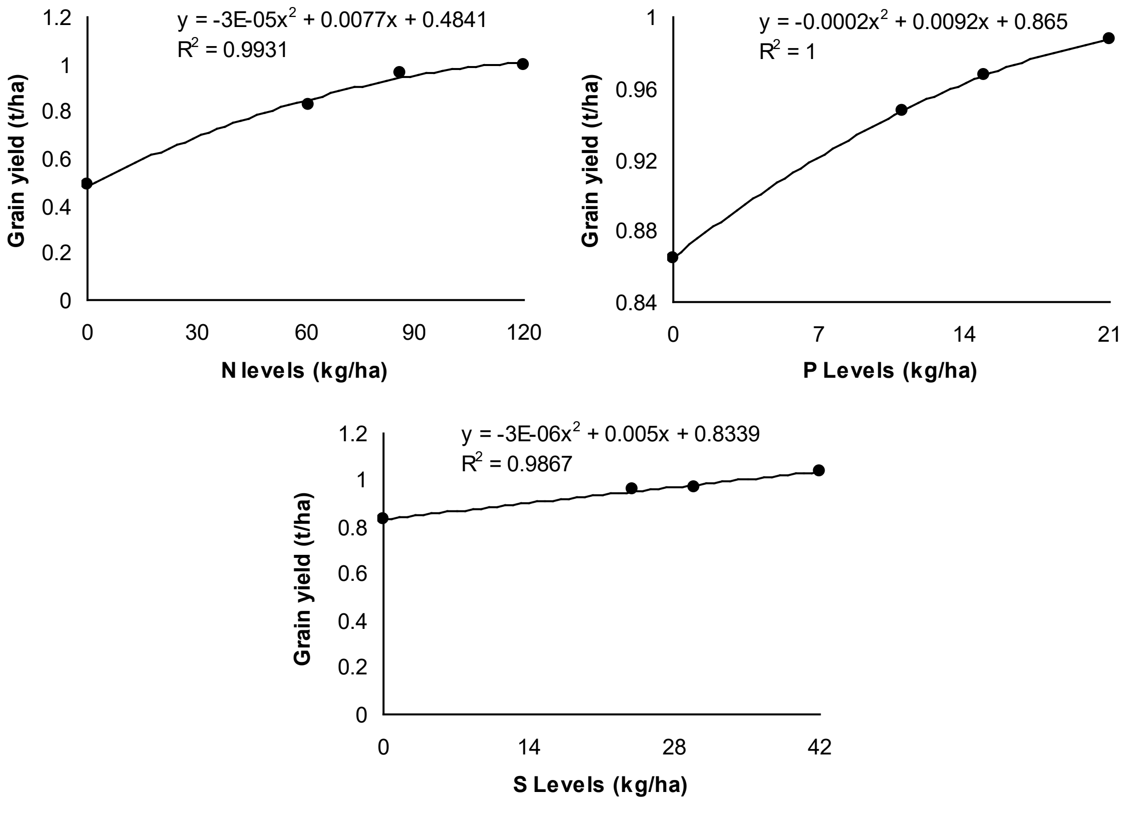


Figure 1. Response of Mustard to NPS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at FSR site Bagherpara, Jessore

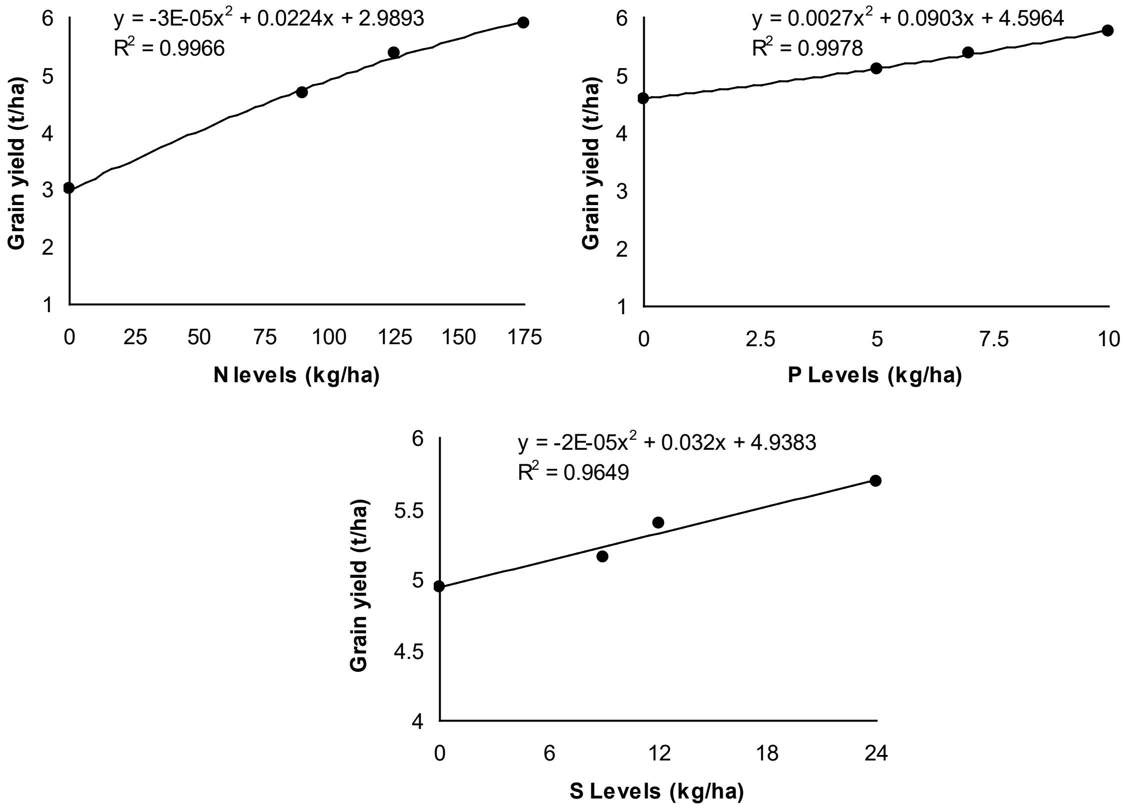


Figure 2. Response of Boro rice to NPS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at FSR site Bagherpara, Jessore

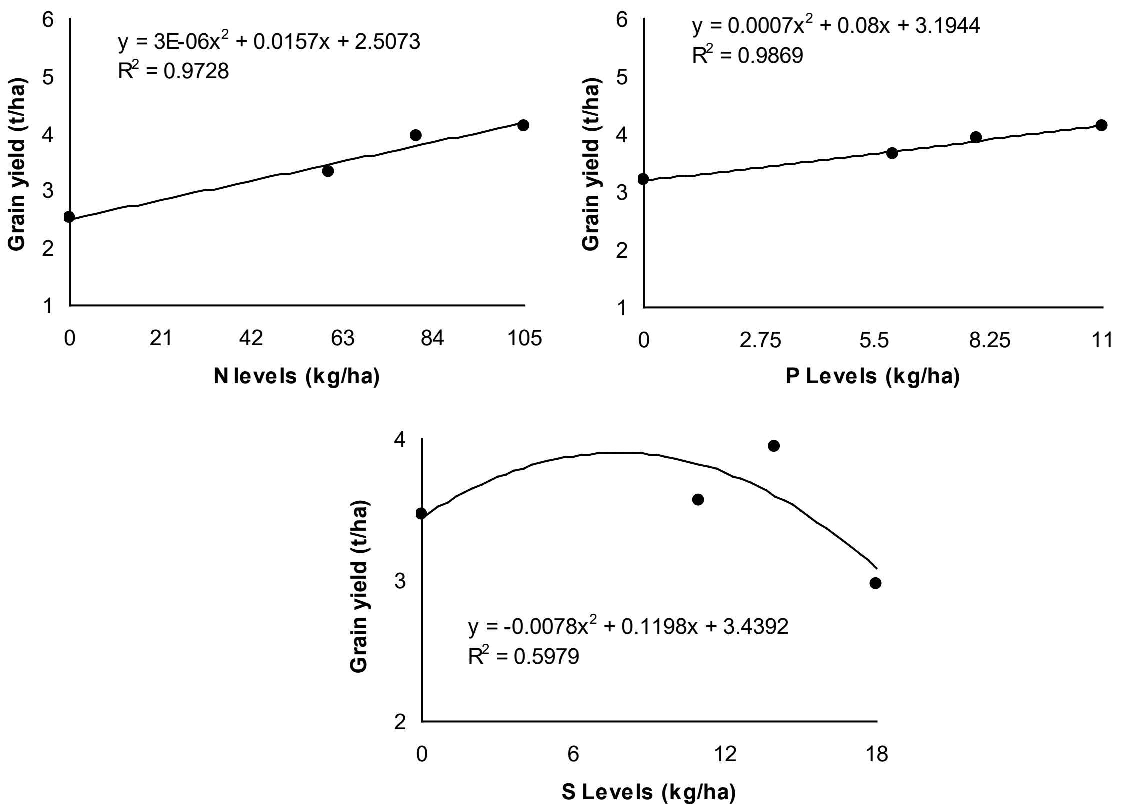


Figure 3. Response of T.Aman rice to NPS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at FSR site Bagherpara, Jessore

Table 1. Effect of different level of fertilizer nutrients on the yield of Mustard in Mustard-Boro-T.Aman cropping pattern at Bagherpara, Jessore, during 1999-2000 to 2001-02

| Fertilizer level | | Grain yield (t/ha) | | | |
|---|---|---|---|---|---|
| | | 1999-2000 | 2000-2001 | 2001-2002 | Average |
| N level (kg/ha) | 0 | 0.228 | 0.652 | 0.580 | 0.487 |
| | 61 | 0.564 | 0.928 | 1.000 | 0.831 |
| | 86 | 0.568 | 1.063 | 1.270 | 0.967 |
| | 120 | 0.561 | 1.110 | 1.330 | 1.000 |
| P level (kg/ha) | 0 | 0.506 | 1.000 | 1.090 | 0.865 |
| | 11 | 0.583 | 1.018 | 1.240 | 0.947 |
| | 15 | 0.568 | 1.063 | 1.270 | 0.967 |
| | 21 | 0.589 | 1.215 | 1.160 | 0.988 |
| S level (kg/ha) | 0 | 0.550 | 1.018 | 0.920 | 0.833 |
| | 24 | 0.561 | 1.115 | 1.270 | 0.962 |
| | 30 | 0.568 | 1.063 | 1.270 | 0.967 |
| | 42 | 0.600 | 1.135 | 1.390 | 1.040 |

Table 2. Effect of different level of fertilizer nutrients on the yield and economics of Boro in Mustard-Boro-T.Aman cropping pattern at Bagherpara, Jessore, during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Average |
| N level (kg/ha) | | | | |
| 0 | 2.73 | 3.45 | 2.83 | 3.00 |
| 90 | 3.55 | 4.77 | 5.68 | 4.67 |
| 125 | 4.30 | 5.87 | 5.99 | 5.39 |
| 175 | 4.83 | 6.41 | 6.49 | 5.91 |
| P level (kg/ha) | | | | |
| 0 | 3.06 | 5.02 | 5.73 | 4.60 |
| 5 | 4.02 | 5.29 | 5.95 | 5.09 |
| 7 | 4.30 | 5.87 | 5.99 | 5.39 |
| 10 | 4.72 | 6.21 | 6.34 | 5.76 |
| S level (kg/ha) | | | | |
| 0 | 4.02 | 5.14 | 5.68 | 4.95 |
| 9 | 4.25 | 5.44 | 5.76 | 5.15 |
| 12 | 4.30 | 5.87 | 5.99 | 5.39 |
| 24 | 4.67 | 6.07 | 6.32 | 5.69 |

Table 3. Effect of different level of fertilizer nutrients on the yield of T.Aman in Mustard-Boro-T.Aman cropping pattern at Bagherpara, Jessore, during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1998-99 | 1999-2000 | 2000-2001 | Average |
| N level (kg/ha) | | | | |
| 0 | 2.00 | 2.90 | 2.65 | 2.52 |
| 60 | 2.57 | 4.11 | 3.35 | 3.34 |
| 80 | 3.48 | 4.79 | 3.56 | 3.94 |
| 105 | 4.14 | 4.81 | 3.43 | 4.13 |
| P level (kg/ha) | | | | |
| 0 | 2.60 | 3.51 | 3.49 | 3.20 |
| 6 | 3.51 | 3.81 | 3.64 | 3.65 |
| 8 | 3.48 | 4.79 | 3.56 | 3.94 |
| 11 | 3.99 | 4.76 | 3.67 | 4.14 |
| S level (kg/ha) | | | | |
| 0 | 2.86 | 4.10 | 3.30 | 3.46 |
| 11 | 3.28 | 4.23 | 3.34 | 3.57 |
| 14 | 3.48 | 4.79 | 3.56 | 3.94 |
| 18 | 4.04 | 4.27 | 3.59 | 2.97 |

**Location : Melandah, Jamalpur**
**Year of establishment: 2001-02**

**Mustard**

In Mustard, a positive response of N was observed. Seed yield increased with the increase of N level and the highest yield was recorded from 100 kg N/ha. Similarly P, K and S also have some response and yield increased up to 24, 26 and 30 kg/ha of P, K and S, respectively.

**Boro**

In Boro rice, grain yield increased up to 145 kg N/ha and then showed to decrease. As regards P, K and S, grain yield increased up to 26, 45 and 22 kg/ha P, K and S, respectively.

**T.Aman**

In T.Aman rice, the grain yield increased markedly up to 100 kg N/ha and then decreased sharply. Similarly P, K and S also showed a positive response and yield increased up to 16, 29 and 13 kg/ha of P, K and S, respectively.

From the data a response curve was drown and the fertilizer dose that maximized yield and profit was find out.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Mustard | 104 | 24 | 26 | 32 | 97 | 22 | 27 | 27 |
| Boro | 144 | 26 | 46 | 23 | 144 | 24 | 45 | 21 |
| T.Aman | 104 | 16 | 29 | 13 | 98 | 14 | 27 | 12 |

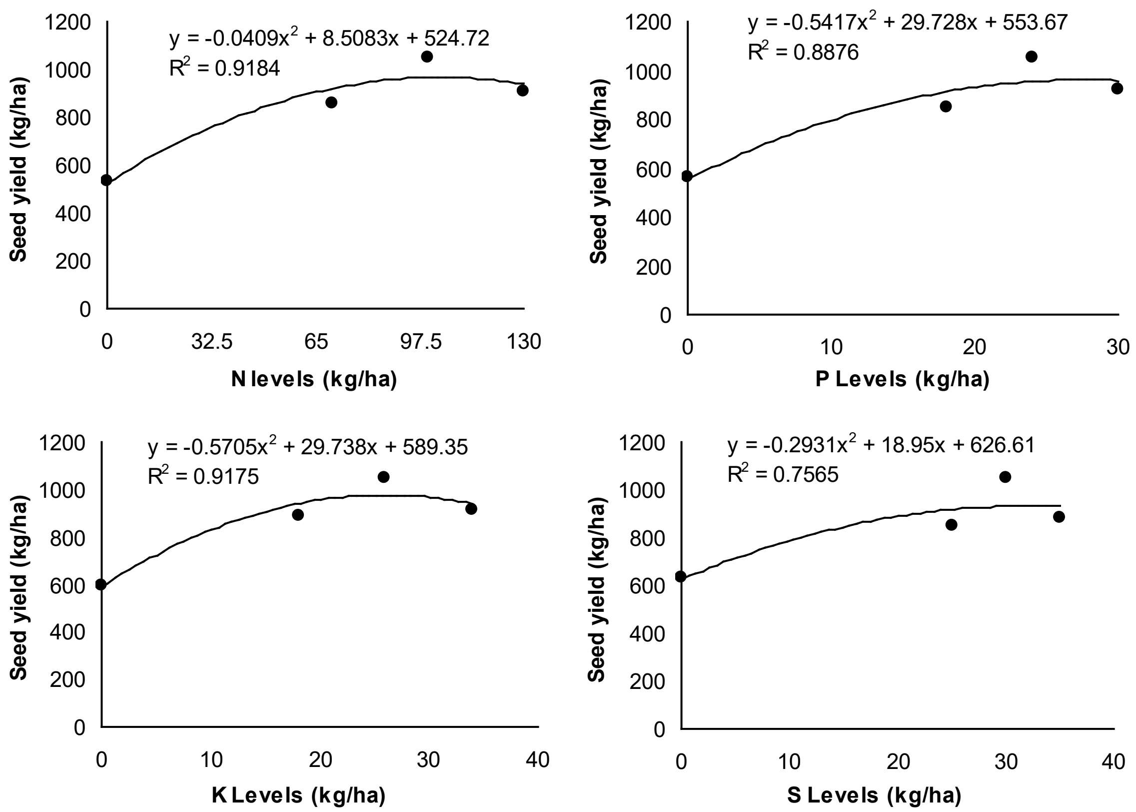


Figure 4. Response of Mustard to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Melandah, Jamalpur

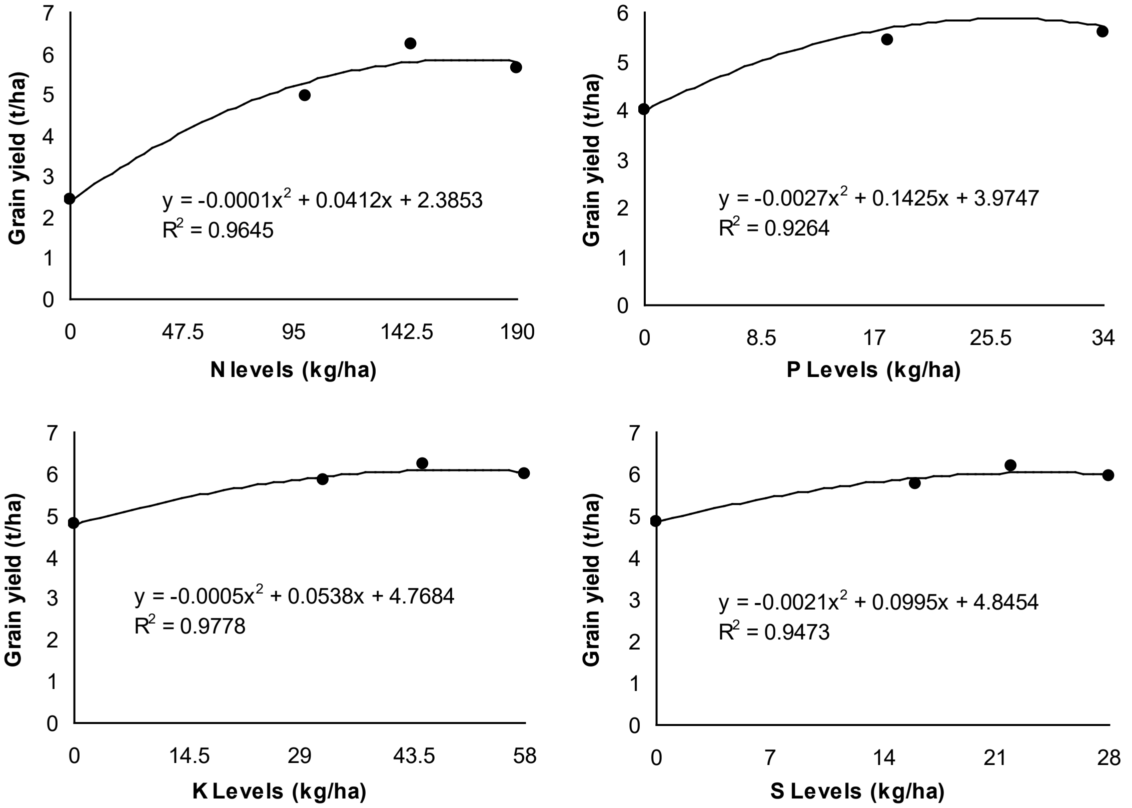


Figure 5. Response of Boro rice to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Melandah, Jamalpur

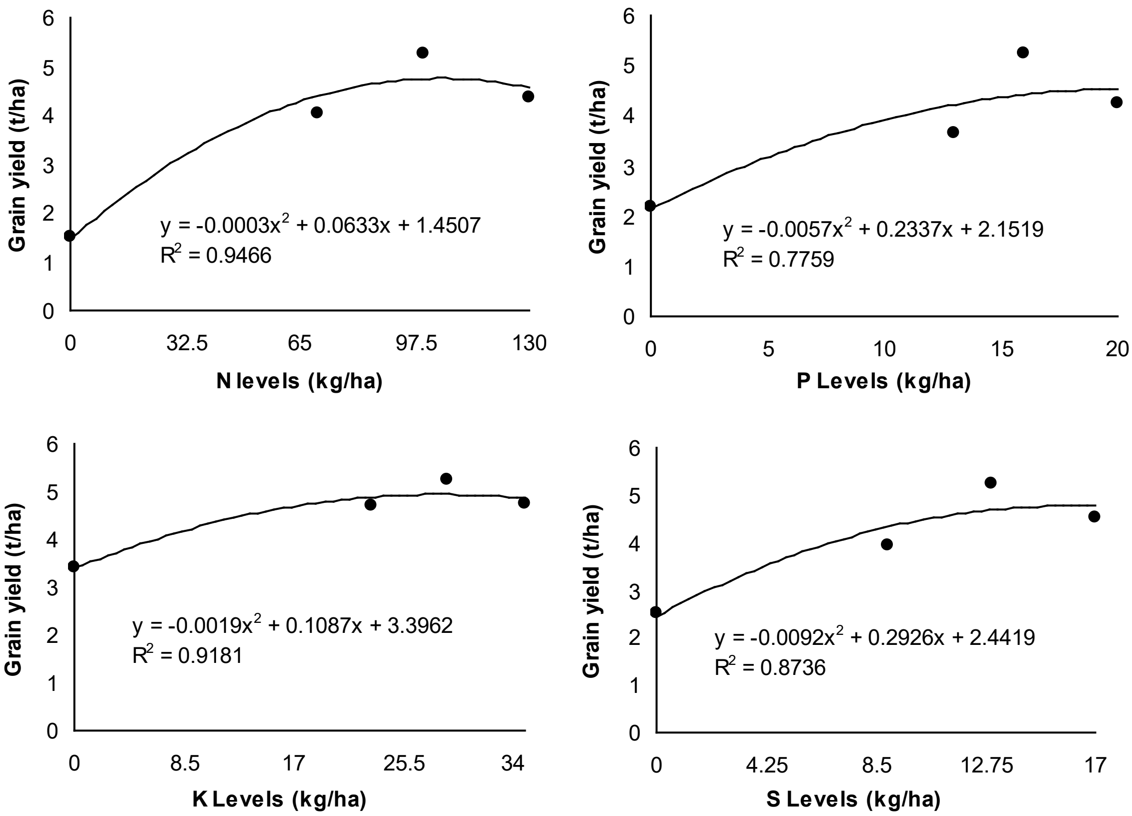


Figure 6. Response of T.Aman rice to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Melandah, Jamalpur

Table 4. Effects of different levels of fertilizer nutrients on the yield of crops in Mustard-Boro-T.Aman cropping pattern at Melandah, Jamalpur, 2001-02

| Nutrient levels (kg/ha) | | | Grain yield | | |
|---|---|---|---|---|---|
| Mustard | Boro | T.Aman | Mustard (kg/ha) | Boro (t/ha) | T.Aman (t/ha) |
| N levels | | | | | |
| 0 | 0 | 0 | 533 | 2.43 | 1.50 |
| 70 | 100 | 70 | 860 | 4.98 | 4.04 |
| 100 | 145 | 100 | 1050 | 6.21 | 5.25 |
| 130 | 190 | 130 | 907 | 5.64 | 4.37 |
| P levels | | | | | |
| 0 | 0 | 0 | 560 | 4.01 | 2.19 |
| 18 | 18 | 13 | 850 | 5.43 | 3.64 |
| 24 | 26 | 16 | 1050 | 6.21 | 5.25 |
| 30 | 34 | 20 | 920 | 5.60 | 4.25 |
| K levels | | | | | |
| 0 | 0 | 0 | 597 | 4.78 | 3.41 |
| 18 | 32 | 23 | 887 | 5.84 | 4.69 |
| 26 | 45 | 29 | 1050 | 6.21 | 5.25 |
| 34 | 58 | 35 | 913 | 6.00 | 4.73 |
| S levels | | | | | |
| 0 | 0 | 0 | 630 | 4.86 | 2.50 |
| 25 | 16 | 9 | 846 | 5.78 | 3.93 |
| 30 | 22 | 13 | 1050 | 6.21 | 5.25 |
| 35 | 28 | 17 | 880 | 5.93 | 4.55 |

**Location : Narikeli, Jamalpur**
**Year of establishment : 2001-02**

**Mustard**

In Mustard, a positive response of N towards the seed yield of Mustard was observed. Seed yield increased with the increase of N level and the highest yield was recorded from 80 kg N/ha. Similarly P, K and S also have some response and yield increased up to 20, 36 and 20 kg/ha of P, K and S, respectively.

**Boro**

In Boro rice, grain yield increased with the increase of N and the highest yield was obtained from 130 kg N/ha and then started to decrease. As regards P, K and S, grain yield increased up to 20, 60 and 20 kg P, K and S, respectively.

**T.Aman**

In T.Aman rice, the grain yield increased markedly up to 60 kg N/ha. Thereafter yield also increased slowly up to 80 kg N/ha and then started to decrease. Similarly P, K and S also showed some response and yield increased up to 16, 45 and 9 kg/ha of P, K and S, respectively.

From the data a response curve was drown and the fertilizer dose that maximized yield was find out.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Mustard | 94 | 20 | 28 | 17 | 73 | 18 | 26 | 16 |
| Boro | 115 | 17 | 60 | 18 | - | - | - | - |
| T.Aman | 83 | 14 | 34 | 7 | - | - | - | - |

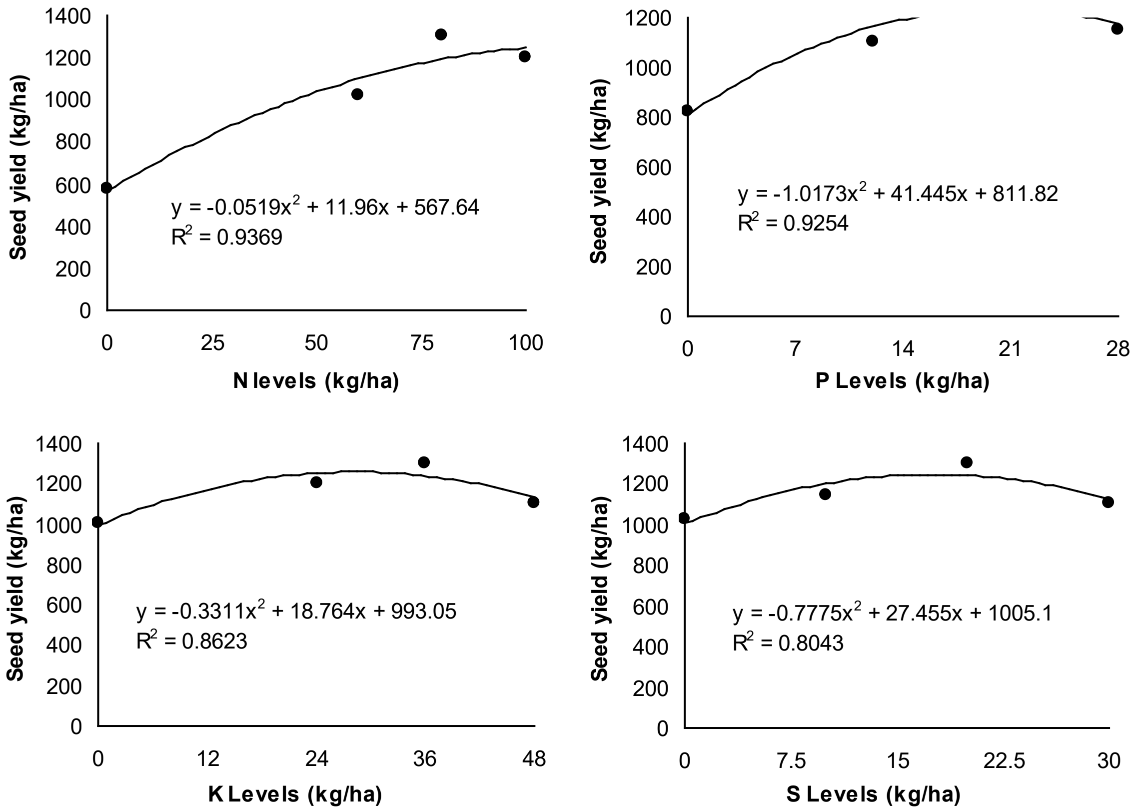


Figure 7. Response of Mustard to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Narikeli, Jamalpur

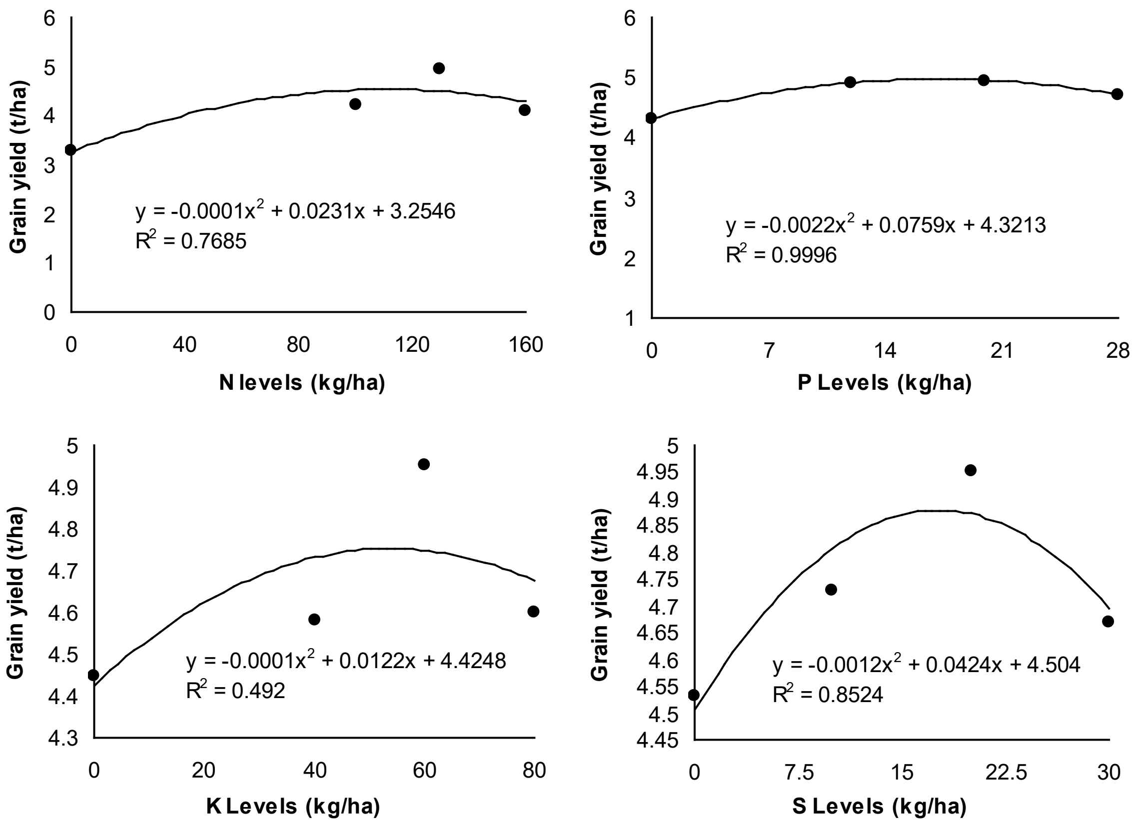


Figure 8. Response of Boro rice to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Narikeli, Jamalpur

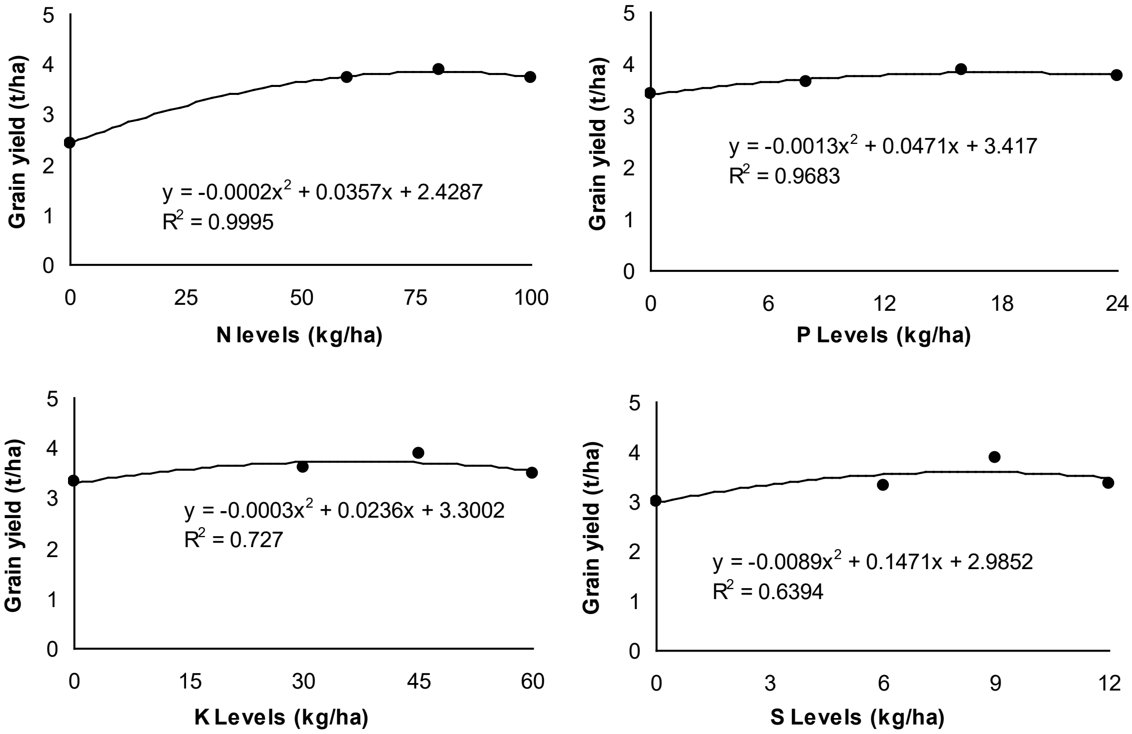


Figure 9. Response of T.Aman rice to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 2001-02 at MLT site Narikeli, Jamalpur

Table 5. Effects of different levels of fertilizer nutrients on the yield of crops in Mustard- Boro - T.Aman cropping pattern at Narikeli, Jamalpur, 2001-02

| Nutrient levels (kg/ha) | | | Grain yield | | |
|---|---|---|---|---|---|
| Mustard | Boro | T.Aman | Mustard (kg/ha) | Boro (t/ha) | T.Aman (t/ha) |
| N levels | | | | | |
| 0 | 0 | 0 | 575 | 3.28 | 2.43 |
| 60 | 100 | 60 | 1025 | 4.23 | 3.75 |
| 80 | 130 | 80 | 1303 | 4.95 | 3.87 |
| 100 | 160 | 100 | 1201 | 4.10 | 3.75 |
| P levels | | | | | |
| 0 | 0 | 0 | 825 | 4.32 | 3.43 |
| 12 | 12 | 8 | 1105 | 4.92 | 3.67 |
| 20 | 20 | 16 | 1303 | 4.95 | 3.87 |
| 28 | 28 | 24 | 1150 | 4.72 | 3.77 |
| K levels | | | | | |
| 0 | 0 | 0 | 1001 | 4.45 | 3.32 |
| 24 | 40 | 30 | 1205 | 4.58 | 3.60 |
| 36 | 60 | 45 | 1303 | 4.95 | 3.87 |
| 48 | 80 | 60 | 1107 | 4.60 | 3.50 |
| S levels | | | | | |
| 0 | 0 | 0 | 1025 | 4.53 | 3.02 |
| 10 | 10 | 6 | 1142 | 4.73 | 3.34 |
| 20 | 20 | 9 | 1303 | 4.95 | 3.87 |
| 30 | 30 | 12 | 1109 | 4.67 | 3.37 |

**Location : Muktagacha, Mymensingh**
**Year of establishment: 1999-2000 to 2001-02**

**Mustard**

Generally seed yield of Mustard was very low even less than present national average. Late sowing and rainfall in early November was the main reason for that lower yield. Average of three years data showed that seed yield was increased with the addition of N fertilizer. Seed yield increased sharply up to the application of 60 kg/ha of N. After that level yield increased slowly up to 80 kg/ha. Response of Mustard to nitrogen was evident. Similarly, response to P, K and S was observed to some extent. Seed yield increased up to 25, 50 and 7 kg/ha of P, K and S, respectively.

**Boro rice**

Grain yield increased with the increase of nitrogen up to 120 kg/ha of N and after that tended to decrease. Similar trend was also observed in case of P, K and S. Grain yield increased up to 24, 45, and 12 kg/ha of P, K and S, respectively.

**T.Aman**

Almost similar trend of response was found in case of T.Aman rice. Grain yield increased up to the application of 60 kg/ha of N and thereafter started to reduce. Similar trend was also observed in case of P, K and S. Grain yield increased up to 16, 60, and 5 kg/ha of P, K and S, respectively.

Generally response of crops to nutrients was quadratic in nature. From the data a response curve was drown.

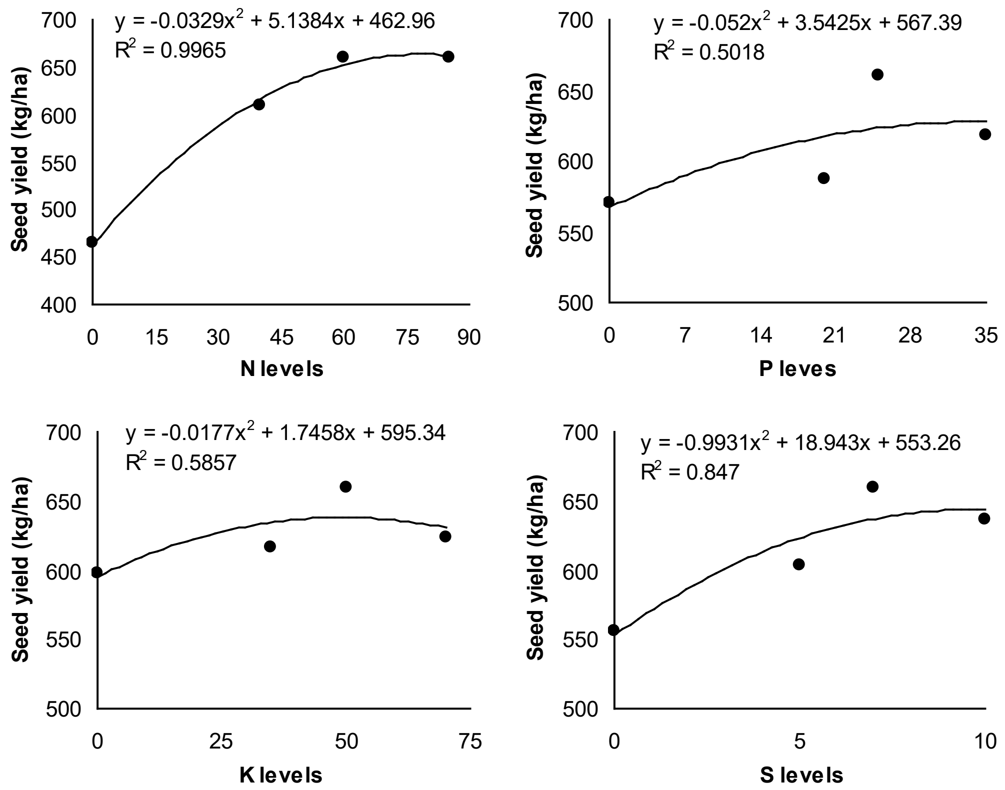


Figure 10. Response of Mustard to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at Muktagacha, Mymensingh

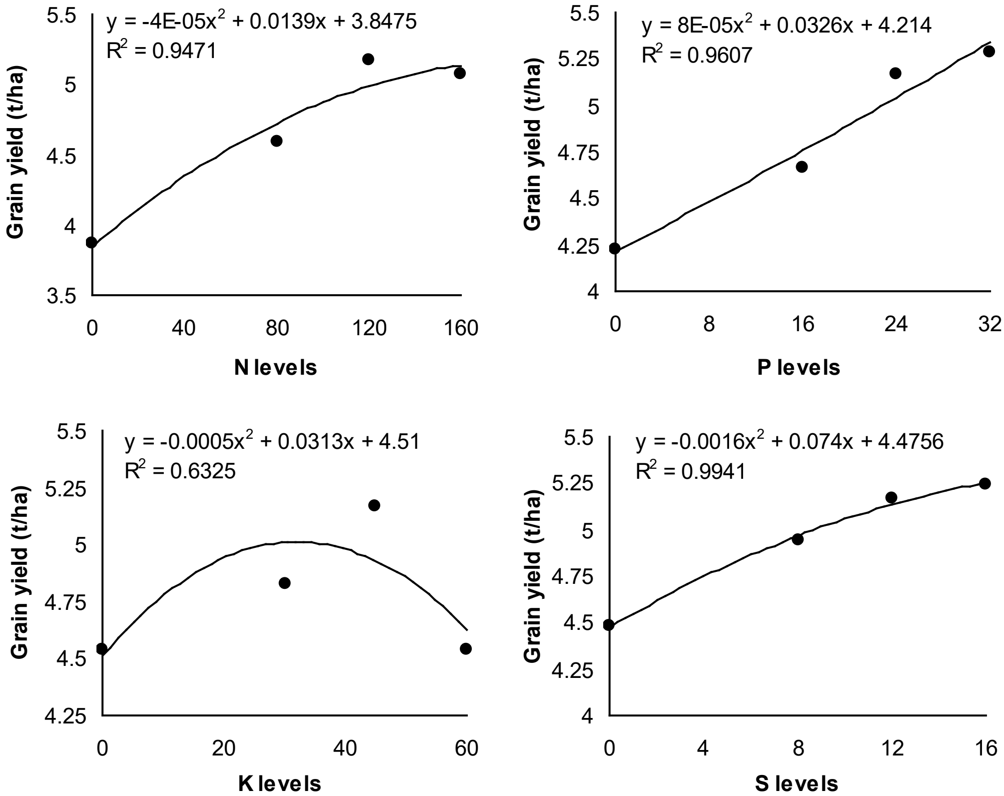


Figure 11. Response of Boro to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at Muktagacha, Mymensingh

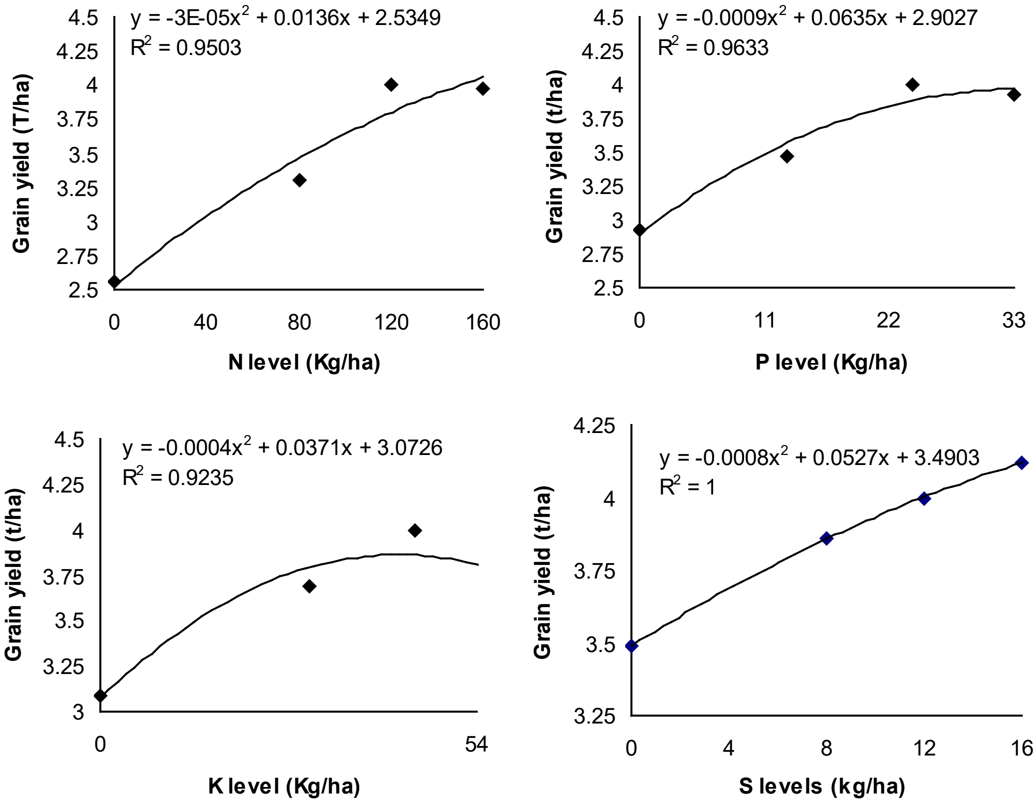


Figure 12. Response of T.Aman to NPKS grown in Mustard-Boro-T.Aman cropping pattern during 1999 to 2002 at Muktagacha, Mymensingh

Table 6. Effect of different level of fertilizer nutrients on the yield of Mustard in Mustard-Boro-T.Aman cropping pattern at Muktagacha, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Average |
| N level (kg/ha) | | | | |
| 0 | 0.397 | 0.383 | 0.613 | 0.464 |
| 40 | 0.450 | 0.500 | 0.880 | 0.610 |
| 60 | 0.453 | 0.540 | 0.986 | 0.660 |
| 80 | 0.503 | 0.600 | 0.876 | 0.660 |
| P level (kg/ha) | | | | |
| 0 | 0.436 | 0.420 | 0.853 | 0.570 |
| 20 | 0.440 | 0.480 | 0.840 | 0.587 |
| 25 | 0.453 | 0.540 | 0.987 | 0.660 |
| 35 | 0.453 | 0.484 | 0.920 | 0.619 |
| K level (kg/ha) | | | | |
| 0 | 0.440 | 0.440 | 0.913 | 0.598 |
| 35 | 0.463 | 0.520 | 0.867 | 0.617 |
| 50 | 0.453 | 0.540 | 0.987 | 0.660 |
| 70 | 0.443 | 0.496 | 0.933 | 0.624 |
| S level (kg/ha) | | | | |
| 0 | 0.400 | 0.410 | 0.853 | 0.556 |
| 5 | 0.453 | 0.480 | 0.880 | 0.604 |
| 7 | 0.453 | 0.540 | 0.987 | 0.660 |
| 10 | 0.450 | 0.500 | 0.960 | 0.637 |

Table 7. Effect of different level of fertilizer nutrients on the yield and economics of Boro in Mustard-Boro-T.Aman cropping pattern at Muktagacha, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Average |
| N level (kg/ha) | | | | |
| 0 | 3.25 | 4.25 | 4.10 | 3.87 |
| 80 | 4.37 | 4.95 | 4.46 | 4.59 |
| 120 | 4.45 | 5.55 | 5.51 | 5.17 |
| 160 | 4.17 | 5.68 | 5.35 | 5.07 |
| P level (kg/ha) | | | | |
| 0 | 4.05 | 4.57 | 4.06 | 4.23 |
| 16 | 4.15 | 5.10 | 4.73 | 4.73 |
| 24 | 4.45 | 5.55 | 5.51 | 5.51 |
| 32 | 4.52 | 5.88 | 5.46 | 5.46 |
| K level (kg/ha) | | | | |
| 0 | 4.28 | 4.78 | 4.56 | 4.56 |
| 30 | 4.40 | 4.93 | 5.11 | 5.11 |
| 45 | 4.45 | 5.55 | 5.51 | 5.51 |
| 60 | 3.53 | 5.45 | 4.63 | 4.63 |
| S level (kg/ha) | | | | |
| 0 | 4.23 | 4.58 | 4.63 | 4.63 |
| 8 | 4.50 | 5.13 | 5.20 | 5.20 |
| 12 | 4.45 | 5.55 | 5.51 | 5.51 |
| 16 | 4.80 | 5.43 | 5.50 | 5.50 |

Table 8. Effect of different level of fertilizer nutrients on the yield of T.Aman in Mustard-Boro-T.Aman cropping pattern Muktagacha, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Average |
| N level (kg/ha) | | | | |
| 0 | 2.84 | 2.83 | 2.00 | 2.56 |
| 45 | 3.92 | 3.70 | 2.30 | 3.31 |
| 60 | 4.31 | 4.13 | 3.57 | 4.00 |
| 85 | 4.41 | 4.53 | 3.00 | 3.98 |
| P level (kg/ha | | | | |
| 0 | 2.99 | 3.13 | 2.67 | 2.93 |
| 13 | 4.09 | 3.73 | 2.58 | 3.47 |
| 16 | 4.31 | 4.13 | 3.57 | 4.00 |
| 23 | 4.36 | 4.16 | 3.25 | 3.92 |
| K level (kg/ha | | | | |
| 0 | 3.43 | 3.40 | 2.44 | 3.09 |
| 45 | 4.22 | 3.90 | 2.95 | 3.69 |
| 60 | 4.31 | 4.13 | 3.57 | 4.00 |
| 85 | 4.09 | 4.03 | 2.93 | 3.68 |
| S level (kg/ha | | | | |
| 0 | 4.00 | 3.90 | 2.58 | 3.49 |
| 4 | 4.59 | 4.23 | 2.75 | 3.86 |
| 5 | 4.31 | 4.13 | 3.57 | 4.00 |
| 7 | 4.50 | 4.20 | 3.67 | 4.12 |

**Cropping pattern : Wheat-Jute- T.Aman**
**Location : Sherpur MLT site, Jamalpur (AEZ 9)**
**Year of establishment : 2001-02**

**Wheat**

Grain yield of Wheat increased with the increase of N levels up to 135 kg/ha of N and then tended to decline. Similarly, P, K and S showed a positive response towards the yield of Wheat. Grain yield increased up to 30, 75 and 25 kg/ha of P, K and S, respectively.

**Jute**

Fibre yield of Jute increased markedly with the increase of N and the highest yield was recorded from 120 kg/ha and then tended to decrease. Similarly response was evident in case of PKS and fibre yield increase appreciably up to 20 kg/ha, 80 kg/ha and 18 kg/ha, respectively.

**T.Aman**

Grain yield of T.Aman rice increased with the increase of N levels up to 100 kg/ha of N and then tended to decrease. Similarly, P, K and S showed a positive response towards the yield of T.Aman rice. Grain yield increased up to 15 kg/ha, 50 kg/ha and 10 kg/ha of P, K and S, respectively.

From the response curve a quadratic relationship was found and the nutrient dose that maximizes yield and profit was found out.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Wheat | 135 | 30 | 75 | 26 | 133 | 30 | 72 | 24 |
| Jute | 132 | 20 | 83 | 18 | 117 | 19 | 76 | 17 |
| T.Aman | 100 | 16 | 49 | 10 | 96 | 14 | 48 | 10 |

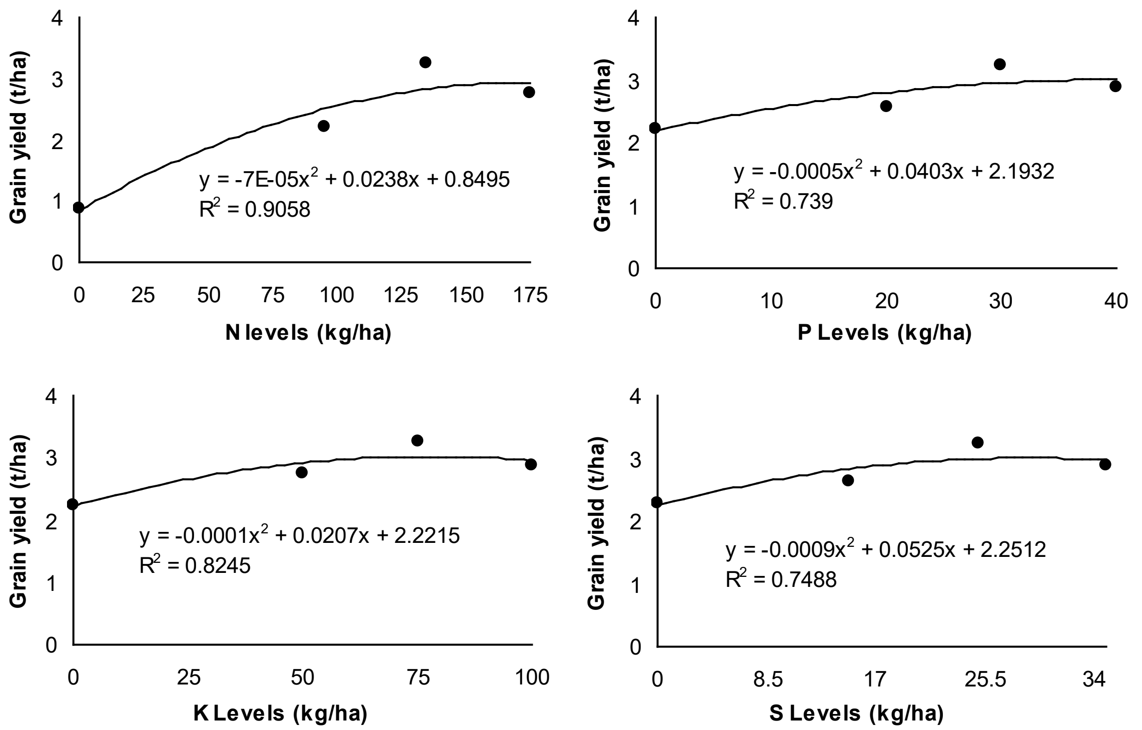


Figure 13. Response of Wheat to NPKS grown in Wheat-Jute -T.Aman cropping pattern during at MLT site, Sherpur 2001-02

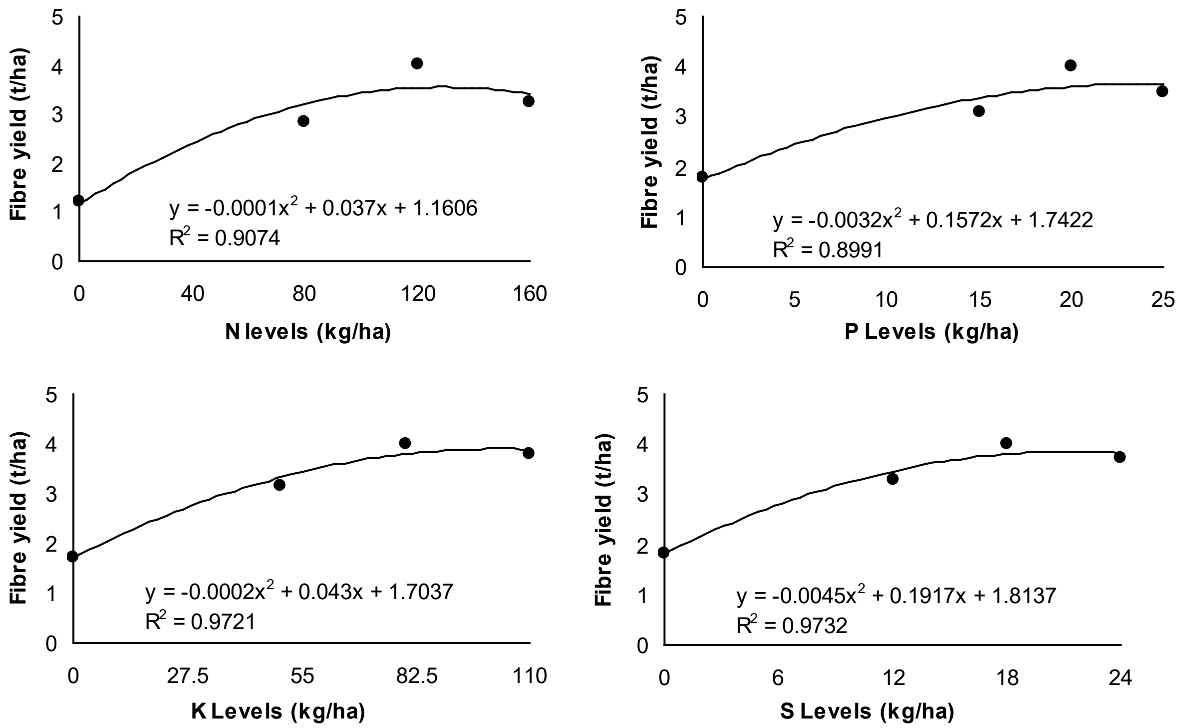


Figure 14. Response of Jute rice to NPKS grown in Wheat-Jute -T.Aman cropping pattern at MLT site, Sherpur during 2001-02

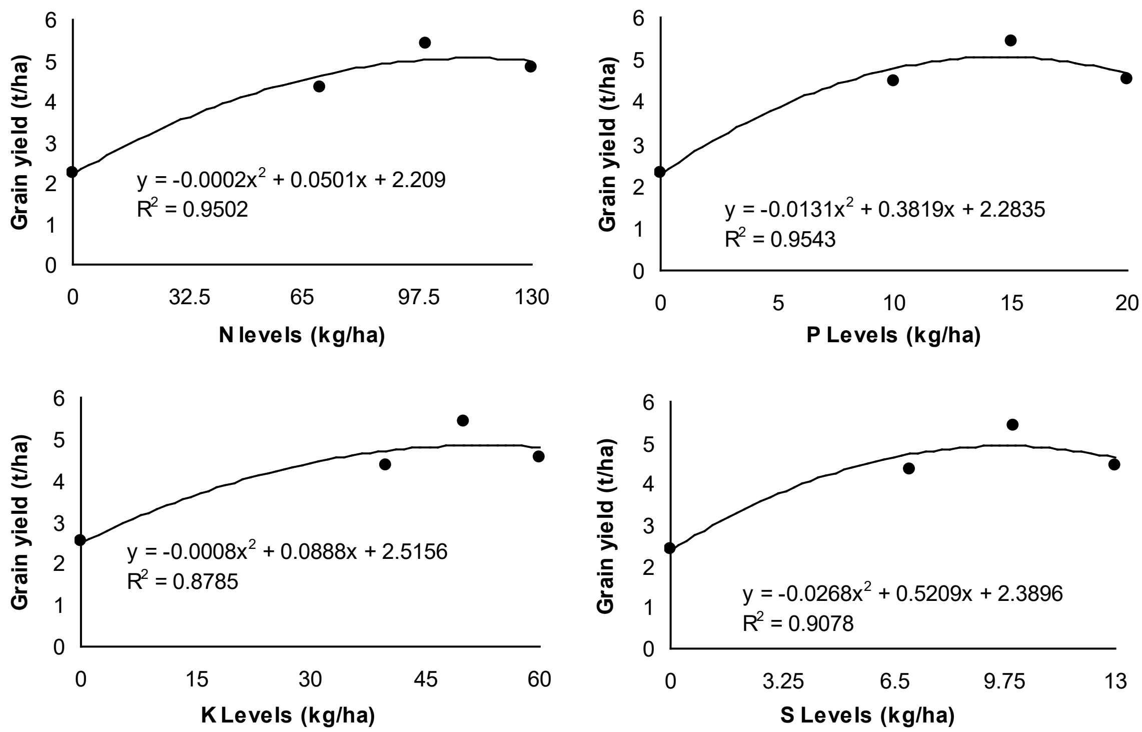


Figure 15. Response of T.Aman to NPKS grown in Wheat-Jute -T.Aman cropping pattern at MLT site, Sherpur during 2001-02

Table 9. Effects of different levels of fertilizer nutrients on the yield of Wheat in Wheat-Jute - T.Aman cropping pattern at Sherpur MLT site, Jamalpur, 2001-02

| Nutrient levels (kg/ha) | | | Grain yield (t/ha) | | |
|---|---|---|---|---|---|
| Wheat | Jute | T.Aman | Wheat | Jute | T.Aman |
| N levels | | | | | |
| 0 | 0 | 0 | 0.89 | 1.22 | 2.25 |
| 95 | 80 | 70 | 2.20 | 2.85 | 4.34 |
| 135 | 120 | 100 | 3.25 | 4.02 | 5.43 |
| 175 | 160 | 130 | 2.78 | 3.25 | 4.84 |
| P levels | | | | | |
| 0 | 0 | 0 | 2.23 | 1.77 | 2.33 |
| 20 | 15 | 10 | 2.58 | 3.10 | 4.51 |
| 30 | 20 | 15 | 3.25 | 4.02 | 5.43 |
| 40 | 25 | 20 | 2.90 | 3.50 | 4.53 |
| K levels | | | | | |
| 0 | 0 | 0 | 2.25 | 1.74 | 2.54 |
| 50 | 50 | 40 | 2.75 | 3.15 | 4.35 |
| 75 | 80 | 50 | 3.25 | 4.02 | 5.43 |
| 100 | 110 | 60 | 2.87 | 3.81 | 4.56 |
| S levels | | | | | |
| 0 | 0 | 0 | 2.3 | 1.84 | 2.44 |
| 15 | 12 | 7 | 2.62 | 3.31 | 4.36 |
| 25 | 18 | 10 | 3.25 | 4.02 | 5.43 |
| 35 | 24 | 13 | 2.88 | 3.75 | 4.44 |

**Cropping pattern : Boro -T.Aman**
**Location : Phulpur, Mymensingh**
**Year of establishment : 1999-2000 to 2001-02**

## Boro

Average of three years data showed that grain yield of Boro rice increased with the increase of nitrogen up 135 kg/ha and thereafter decline. Soil was deficient in N and therefore, response of N towards the yield was observed. In case of P, K and S the response was not clear towards the yield. Initially soil was not deficit with P and K, status was medium. Therefore, response of P and K was not evident. However, soil was deficient with S but response was not very clear. Grain yield increased slightly up to 20 kg/ha of S.

## T.Aman

Average data showed that grain yield increased linearly with the increase of N and the highest yield was obtained from the highest level. As the yield increase linearly with the increase of N, therefore, it was not possible to find out the optimum rate. In case of P, K and S no appreciable yield increase was observed. However, soil was deficient with S but response was not very clear towards the yield.

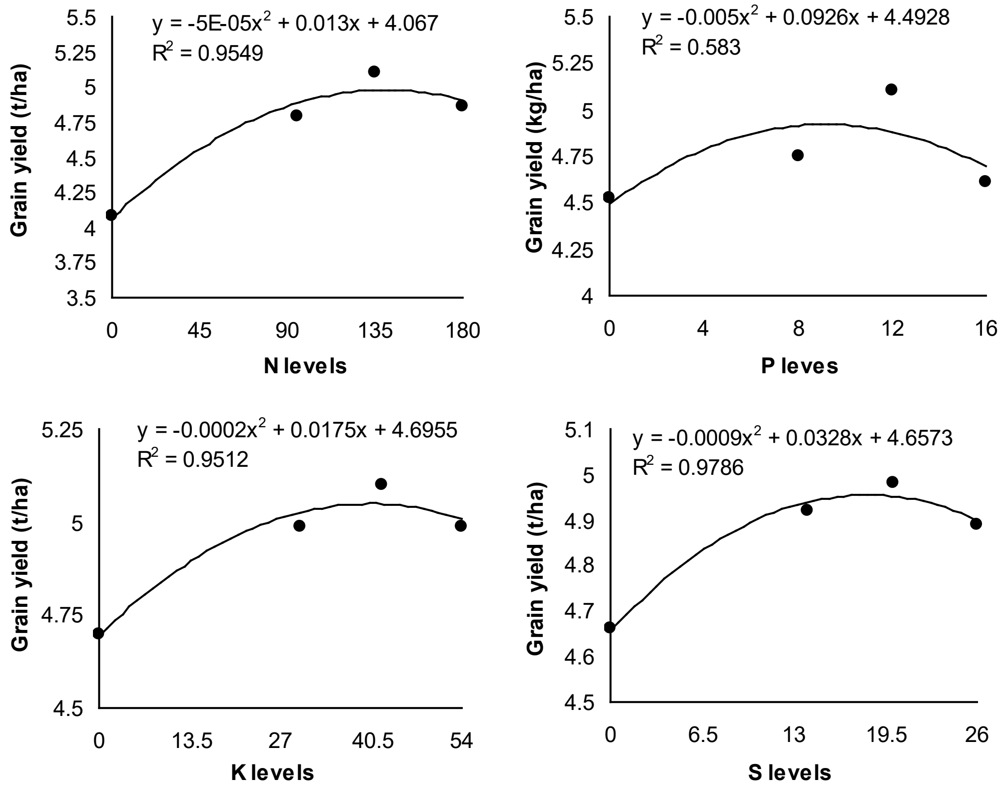


Figure 16. Response of Boro to NPKS grown in Boro-T.Aman cropping pattern at Phulpur, Mymensingh in 2000 to 2002

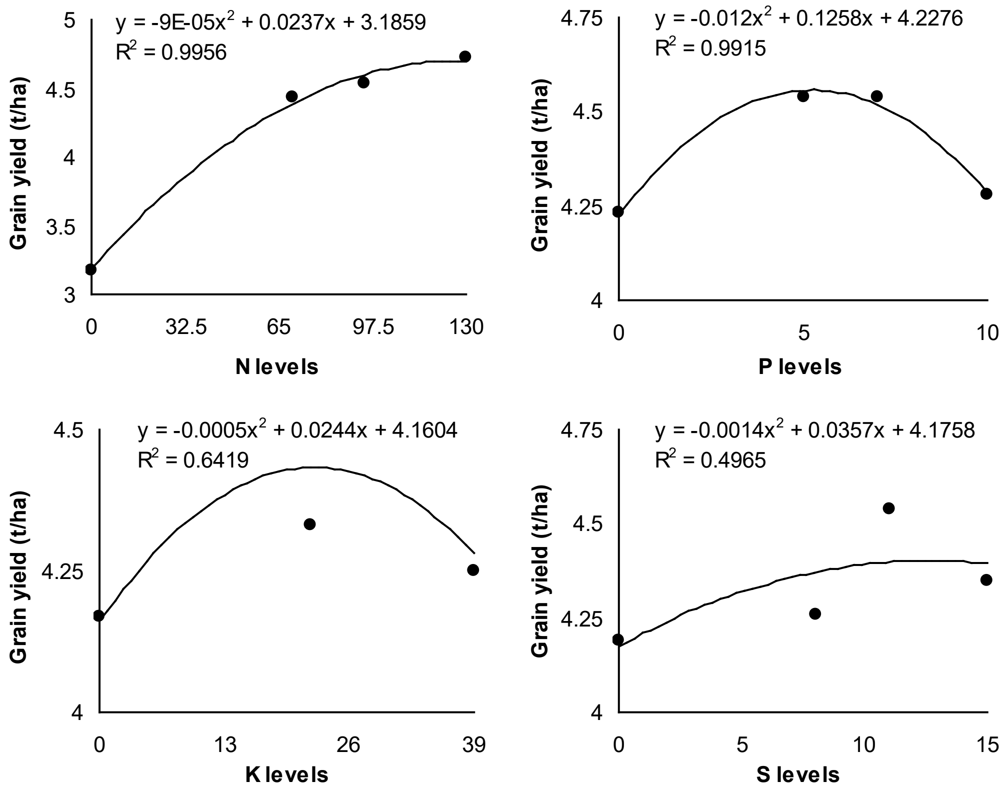


Figure 17. Response of T.Aman to NPKS grown in Boro-T.Aman cropping pattern at Phulpur, Mymensingh in 2000 to 2002

Table 10. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro -T.Aman cropping pattern at Phulpur MLT site, Mymensingh, during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | | | | |
| 0 | 3.85 | 4.44 | 3.95 | 4.08 |
| 95 | 4.79 | 5.08 | 4.49 | 4.79 |
| 135 | 4.84 | 5.36 | 5.10 | 5.10 |
| 180 | 4.40 | 5.54 | 4.63 | 4.86 |
| P level (kg/ha) | | | | |
| 0 | 4.28 | 4.88 | 4.41 | 4.52 |
| 8 | 4.43 | 5.25 | 4.58 | 4.75 |
| 12 | 4.84 | 5.36 | 5.10 | 5.10 |
| 16 | 4.40 | 5.03 | 4.41 | 4.61 |
| K level (kg/ha) | | | | |
| 0 | 4.40 | 5.09 | 4.61 | 4.70 |
| 30 | 4.91 | 5.11 | 4.95 | 4.75 |
| 42 | 4.84 | 5.36 | 5.10 | 5.10 |
| 54 | 4.50 | 5.33 | 4.68 | 4.61 |
| S level (kg/ha) | | | | |
| 0 | 4.58 | 4.89 | 4.52 | 4.66 |
| 14 | 4.92 | 5.23 | 4.62 | 4.92 |
| 20 | 4.48 | 5.36 | 5.10 | 4.98 |
| 26 | 4.26 | 5.53 | 4.88 | 4.89 |

Table 11. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro - T.Aman cropping pattern at Phulpur MLT site, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | | | | |
| 0 | 2.83 | 3.22 | 3.50 | 3.18 |
| 70 | 4.44 | 4.55 | 4.33 | 4.44 |
| 95 | 4.55 | 4.32 | 4.75 | 4.54 |
| 130 | 5.10 | 4.66 | 4.40 | 4.72 |
| P level (kg/ha) | | | | |
| 0 | 4.35 | 4.15 | 4.20 | 4.23 |
| 5 | 4.88 | 4.52 | 4.26 | 4.54 |
| 7 | 4.55 | 4.32 | 4.75 | 4.54 |
| 10 | 4.34 | 4.22 | 4.30 | 4.28 |
| K level (kg/ha) | | | | |
| 0 | 4.13 | 4.08 | 4.30 | 4.17 |
| 22 | 4.28 | 4.25 | 4.45 | 4.33 |
| 28 | 4.55 | 4.32 | 4.75 | 4.54 |
| 38 | 4.30 | 4.11 | 4.34 | 4.25 |
| S level (kg/ha) | | | | |
| 0 | 4.18 | 4.12 | 4.28 | 4.19 |
| 8 | 4.28 | 4.16 | 4.35 | 4.26 |
| 11 | 4.55 | 4.32 | 4.75 | 4.54 |
| 15 | 4.24 | 4.23 | 4.58 | 4.35 |

**Cropping pattern : Boro -T.Aman**
**Location : Norail, Jessore**
**Year of establishment : 1999-2000 to 2001-02**

**Boro**

Average of three years data showed that grain yield increased linearly with the increase of N levels and the highest yield was recorded from the highest level of N. In case of P, grain yield increased linearly but slowly and the highest yield was recorded from the highest level of P. Initial soil nutrient status showed that soil was deficit with N and P and status of K and S was quiet high. Therefore, response to K and S was not studied. As the trend was linear, therefore, it is not possible to find out the optimum rate of nutrients.

**T.Aman**

Similar trend was found in T.Aman rice like Boro rice. Grain yield increased linearly with the increase of N and the highest yield was obtained from the highest level. In case of P similar trend was observed. As the trend was linear, therefore, it is not possible to find out the optimum rate of nutrients.

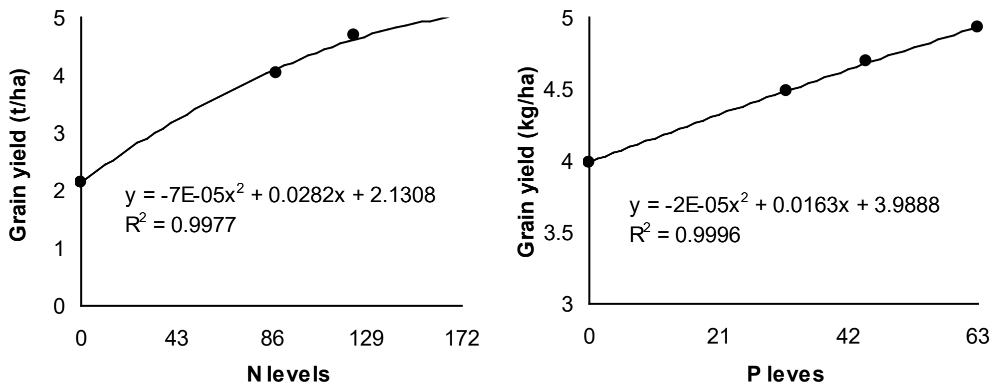


Figure 18. Response of Boro to NP grown in Boro-T.Aman cropping pattern at MLT site, Norail during 1999-2000 to 2001-02

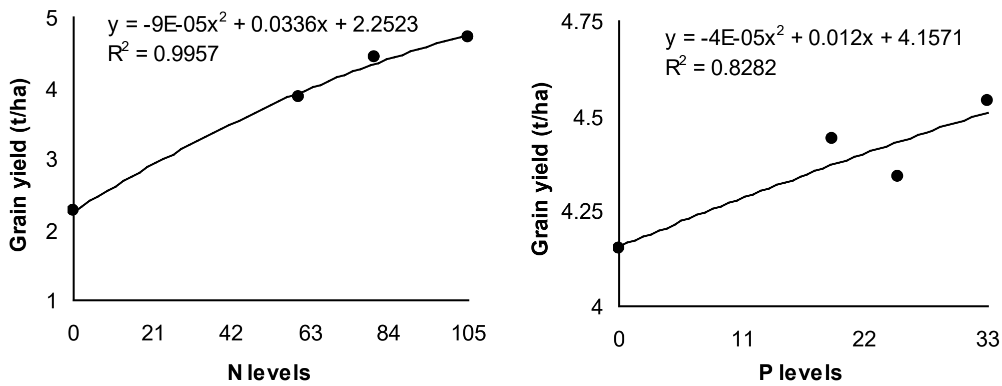


Figure 19. Response of T.Aman to NP grown in Boro-T.Aman cropping pattern at MLT site, Norail during 1999-2000 to 2001-02

Table 12. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro -T.Aman cropping pattern at Norail, Jessore during 1999-2000 to 2001-02

| Fertilizer level | | Grain yield (t/ha) | | | |
|---|---|---|---|---|---|
| | | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | 0 | 2.04 | 2.03 | 2.35 | 2.14 |
| | 88 | 4.27 | 4.00 | 3.86 | 4.04 |
| | 123 | 4.80 | 4.53 | 4.76 | 4.69 |
| | 172 | 5.60 | 4.72 | 4.75 | 5.02 |
| P level (kg/ha) | 0 | 3.40 | 4.16 | 4.41 | 3.99 |
| | 32 | 4.55 | 4.49 | 4.40 | 4.48 |
| | 45 | 4.80 | 4.53 | 4.76 | 4.69 |
| | 63 | 5.08 | 4.73 | 4.99 | 4.93 |

Table 13. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro - T.Aman cropping pattern at Norail, Jessore during 1999-2000 to 2001-02

| Fertilizer level | | Grain yield (t/ha) | | | |
|---|---|---|---|---|---|
| | | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | 0 | 1.99 | 1.97 | 2.83 | 2.26 |
| | 60 | 3.44 | 3.67 | 4.49 | 3.86 |
| | 80 | 4.19 | 4.15 | 4.99 | 4.44 |
| | 105 | 4.60 | 4.29 | 5.27 | 4.72 |
| P level (kg/ha) | 0 | 4.19 | 3.93 | 4.65 | 4.15 |
| | 25 | 4.15 | 3.88 | 4.89 | 4.34 |
| | 19 | 4.19 | 4.15 | 4.99 | 4.44 |
| | 33 | 4.49 | 4.05 | 5.08 | 4.54 |

**Location : Netrakona, Mymensingh**
**Year of establishment: 1999-2000 to 2001-02**

### Boro

Average of three years data showed that grain yield was increased linearly with the increase of N levels and the highest yield was recorded from the highest level of N. As the yield increase linearly with the increase of N, therefore, it was not possible to find out the optimum rate. Another higher level of N should be included in future to find out the optimum rate of N for Boro rice.

In case of P response was also observed to some extent. Grain yield increased slowly up to the application of 12 kg/ha of P. Initial K status of the soil was very high, therefore, response of K was not evident. The initial S status of the soil was very low but the response was not clear. However, grain yield increased slowly up to 20 kg/ha of S.

### T.Aman

Response of T.Aman rice to N was observed. Grain yield increased sharply up to 70 kg/ha of N and thereafter slowly increased up to 95 kg/ha then tended to decrease. In case of P and S the response is not clear but yield increase slowly but linearly and the highest yield was recorded from the highest level of P and S. As the initial K status of the soil was very high, therefore, response of K was not evident.

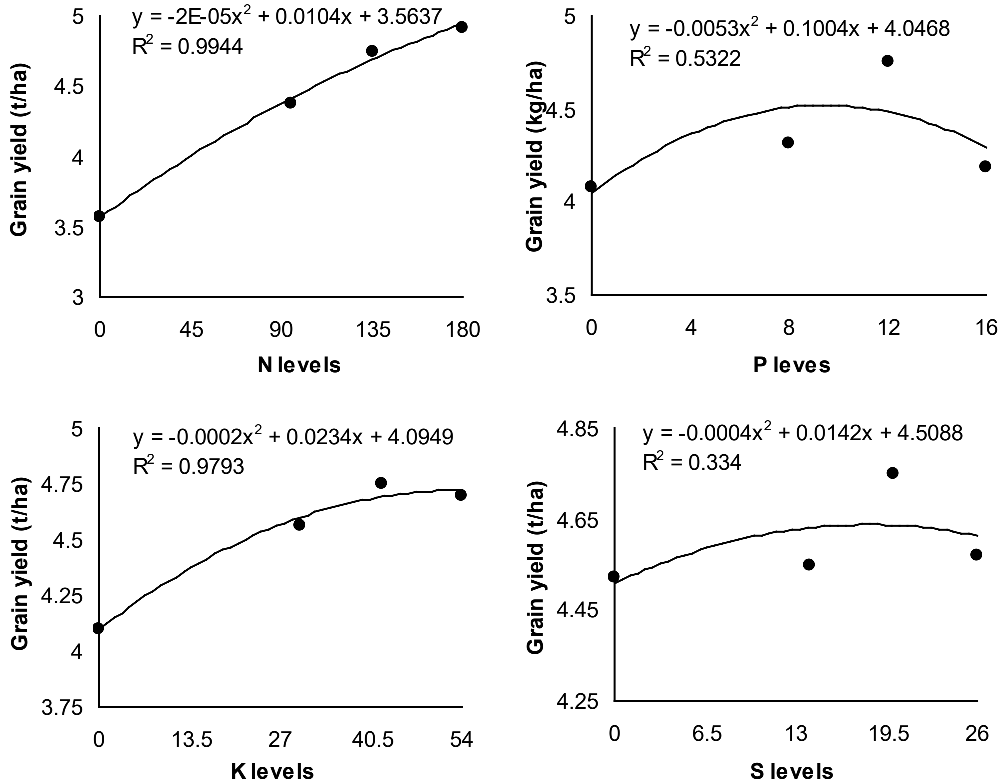


Figure 20. Response of Boro to NPKS grown in Boro-T.Aman cropping pattern at Netrakona, Mymensingh in 2000 to 2002

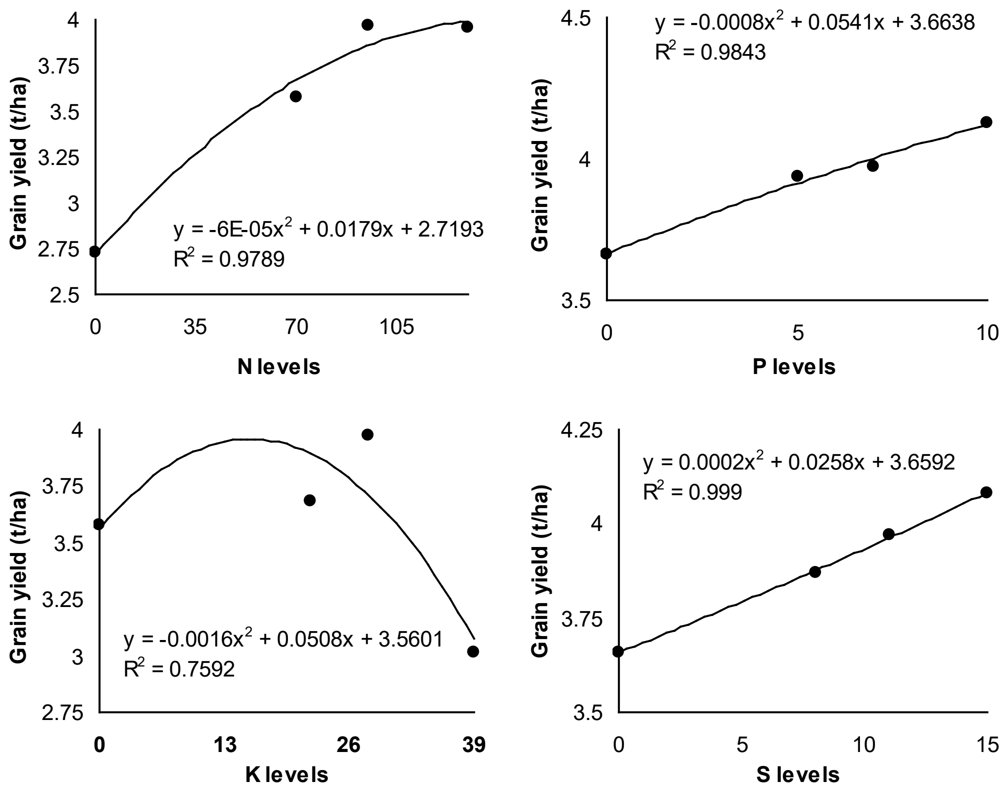


Figure 21. Response of T.Aman to NPKS grown in Boro-T.Aman cropping pattern at Netrakona, Mymensingh in 2000 to 2002

Table 14. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro -T.Aman cropping pattern at Netrakona MLT site, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | | | | |
| 0 | 3.20 | 3.79 | 3.72 | 3.57 |
| 95 | 3.73 | 4.53 | 4.85 | 4.37 |
| 135 | 3.94 | 4.85 | 5.47 | 4.45 |
| 180 | 4.11 | 5.44 | 5.20 | 4.92 |
| P level (kg/ha) | | | | |
| 0 | 3.61 | 4.30 | 4.32 | 4.08 |
| 8 | 3.83 | 4.43 | 4.67 | 4.31 |
| 12 | 3.94 | 4.85 | 5.47 | 4.75 |
| 16 | 3.98 | 4.53 | 4.07 | 4.19 |
| K level (kg/ha) | | | | |
| 0 | 3.97 | 4.28 | 4.05 | 4.10 |
| 30 | 4.04 | 4.73 | 4.92 | 4.56 |
| 42 | 3.94 | 4.85 | 5.47 | 4.75 |
| 54 | 3.78 | 5.11 | 5.22 | 4.70 |
| S level (kg/ha) | | | | |
| 0 | 4.00 | 4.56 | 5.00 | 4.52 |
| 14 | 4.03 | 4.74 | 4.87 | 4.55 |
| 20 | 3.94 | 4.85 | 5.47 | 4.75 |
| 26 | 4.01 | 4.83 | 4.87 | 4.57 |

Table 15.Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro T.Aman cropping pattern at Netrakona MLT site, Mymensingh during 1999-2000 to 2001-02

| Fertilizer level | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-02 | Average |
| N level (kg/ha) | | | | |
| 0 | 2.65 | 2.89 | 2.66 | 2.73 |
| 70 | 4.22 | 3.26 | 3.26 | 3.58 |
| 95 | 4.45 | 3.71 | 3.76 | 3.97 |
| 130 | 4.43 | 4.25 | 3.20 | 3.96 |
| P level (kg/ha) | | | | |
| 0 | 4.25 | 3.62 | 3.12 | 3.66 |
| 5 | 4.60 | 4.01 | 3.22 | 3.94 |
| 7 | 4.45 | 3.71 | 3.76 | 3.97 |
| 10 | 4.63 | 4.24 | 3.52 | 4.13 |
| K level (kg/ha) | | | | |
| 0 | 3.85 | 3.49 | 3.39 | 3.58 |
| 22 | 3.83 | 3.86 | 3.37 | 3.68 |
| 28 | 4.45 | 3.71 | 3.76 | 3.97 |
| 38 | 4.15 | 4.40 | 3.49 | 3.01 |
| S level (kg/ha) | | | | |
| 0 | 4.18 | 3.75 | 3.04 | 3.66 |
| 8 | 4.33 | 3.90 | 3.37 | 3.87 |
| 11 | 4.45 | 3.71 | 3.76 | 3.97 |
| 15 | 4.67 | 4.06 | 3.50 | 4.08 |

**Location : Kishoregonj**
**Year of establishment: 2000 to 2002**

**Boro**

Average of three years data showed that grain yield increased markedly with the increase of nitrogen up to 80 kg N/ha and after that level increased slowly up to 115 kg/ha of N. In case of P, K and S positive response was found to some extent. Yield increased slowly up to the application of 32, 55 and 9 kg/ha of P, K and S, respectively.

**T.Aman**

In T.Aman rice, a positive response of N was also observed and the grain yield increased rapidly up to 55 kg N/ha and then increased slowly up to 75 kg/ha. A very small response of P, K and S was also observed and grain yield increased up to 21 , 36 and 5 kg/ha of P, K and S, respectively.

The trend of response was more or less quadratic in nature. From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 118 | 25 | 43 | 7 | 96 | 24 | 34 | 7 |
| T.Aman | 95 | 26 | 18 | 4 | 84 | 24 | 12 | 4 |

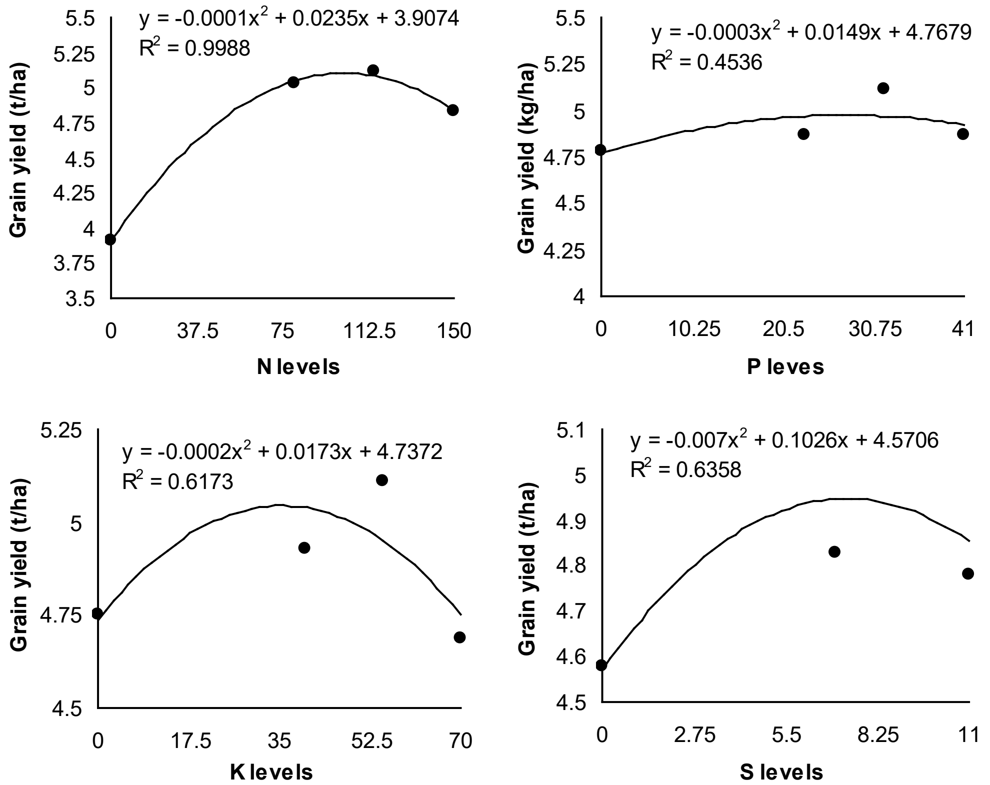


Figure 22. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at Kishoregonj during 2000 to 2002

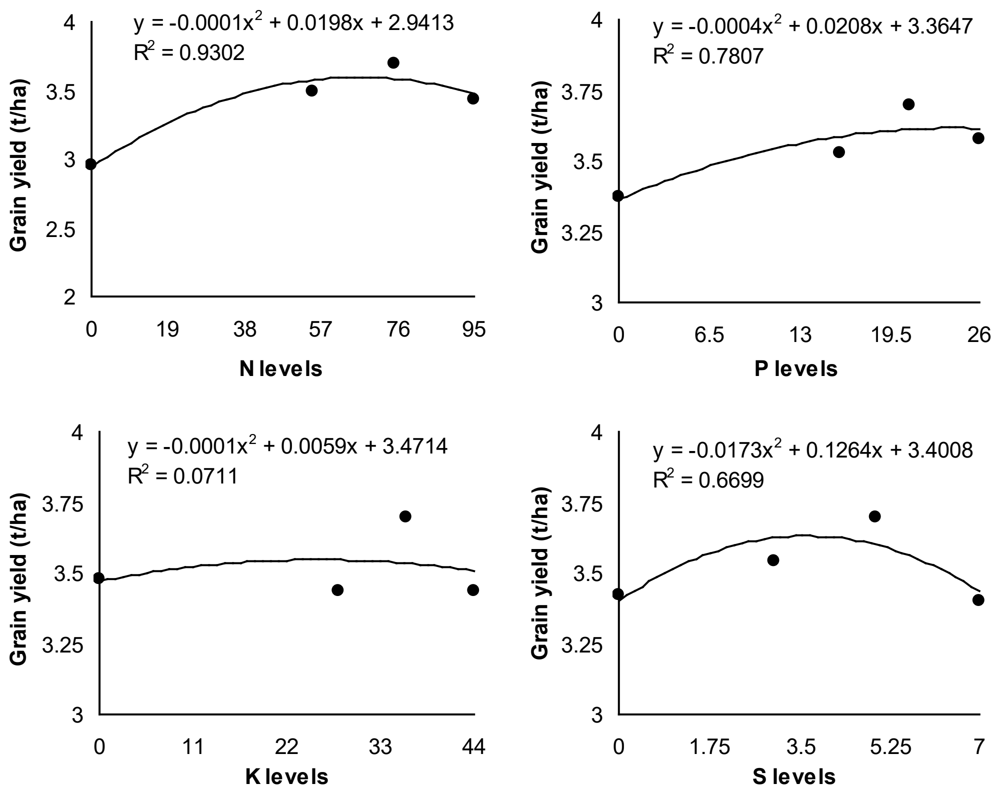


Figure 23. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at Kishoregonj during 2000 to 2002

Table 16. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro-T.Aman cropping pattern at Kishoregonj, 2000 to 2002

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 4.10 | 4.18 | 3.46 | 3.91 |
| 80 | 5.65 | 5.26 | 4.19 | 5.03 |
| 115 | 5.50 | 5.44 | 4.38 | 5.11 |
| 150 | 5.13 | 5.06 | 4.30 | 4.83 |
| P (Levels) | | | | |
| 0 | 5.11 | 5.21 | 4.02 | 4.78 |
| 23 | 5.15 | 5.20 | 4.26 | 4.87 |
| 32 | 5.50 | 5.44 | 4.38 | 5.11 |
| 41 | 5.15 | 5.13 | 4.32 | 4.87 |
| K (Levels) | | | | |
| 0 | 5.13 | 4.82 | 4.29 | 4.75 |
| 40 | 5.32 | 5.17 | 4.29 | 4.93 |
| 55 | 5.50 | 5.44 | 4.38 | 5.11 |
| 70 | 4.61 | 5.10 | 4.35 | 4.69 |
| S (Levels) | | | | |
| 0 | 4.82 | 4.82 | 4.09 | 4.58 |
| 7 | 5.22 | 4.98 | 4.28 | 4.83 |
| 9 | 5.50 | 5.44 | 4.38 | 5.11 |
| 11 | 5.02 | 5.01 | 4.32 | 4.78 |

Table 17. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro-T.Aman cropping pattern at Kishoregonj, 2000 to 2002

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 3.15 | 3.08 | 2.62 | 2.95 |
| 55 | 3.65 | 3.85 | 2.99 | 3.50 |
| 75 | 3.77 | 4.18 | 3.15 | 3.70 |
| 95 | 3.63 | 3.72 | 2.94 | 3.43 |
| P (Levels) | | | | |
| 0 | 3.49 | 3.78 | 2.84 | 3.37 |
| 16 | 3.66 | 3.97 | 2.95 | 3.53 |
| 21 | 3.77 | 4.18 | 3.15 | 3.70 |
| 26 | 3.69 | 3.89 | 3.15 | 3.58 |
| K (Levels) | | | | |
| 0 | 3.58 | 3.75 | 3.12 | 3.48 |
| 28 | 3.66 | 3.87 | 2.79 | 3.44 |
| 36 | 3.77 | 4.18 | 3.15 | 3.70 |
| 44 | 3.57 | 3.90 | 2.86 | 3.44 |
| S (Levels) | | | | |
| 0 | 3.55 | 3.72 | 3.00 | 3.42 |
| 3 | 3.58 | 4.00 | 3.03 | 3.54 |
| 5 | 3.77 | 4.18 | 3.15 | 3.70 |
| 7 | 3.60 | 3.71 | 2.89 | 3.40 |

**Location : Kendua MLT site, Kishoreganj**
**Year of establishment: 2000-2002**

**Boro**

From the Mean data it was observed that in Boro rice, grain yield increased markedly with the increase of nitrogen up to 90 kg N/ha and after that level the rate (125 kg/ha) of increment was slow. In case of P and K a slow but positive response was found and the yield increased up to the application of 36 and 64 kg/ha of P and K, respectively. A positive response to sulphur was also observed to some extent and grain yield increased up to 22 kg/ha of S.

**T.Aman**

In T.Aman rice, almost similar trend like Boro rice was found. However, yield did not increase markedly due to increase of nutrient levels. Yield increased slowly up to the application of 76, 23, 42 and 12 kg/ha of NPKS, respectively.

From the response curve a quadratic relationship was observed and the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 130 | 33 | 60 | 22 | 84 | 25 | 57 | 15 |
| T.Aman | 80 | 22 | 32 | 9 | 78 | 18 | 25 | 8 |

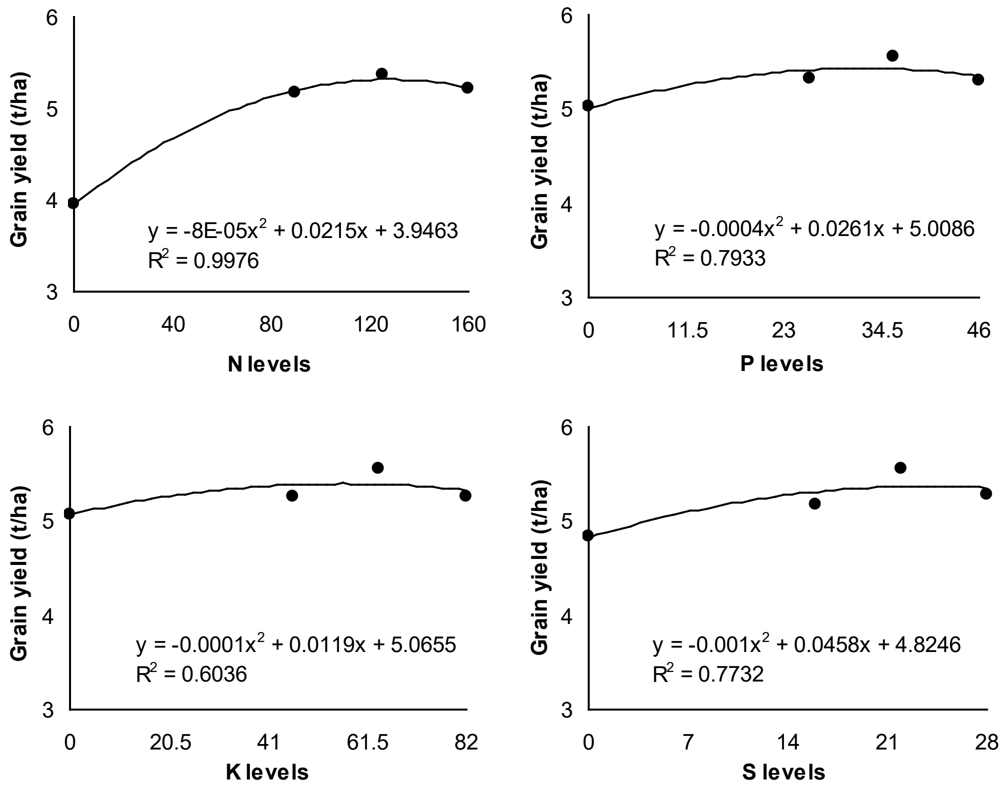


Figure 24. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at Kendua, Kishoregonj during 2000 to 2002

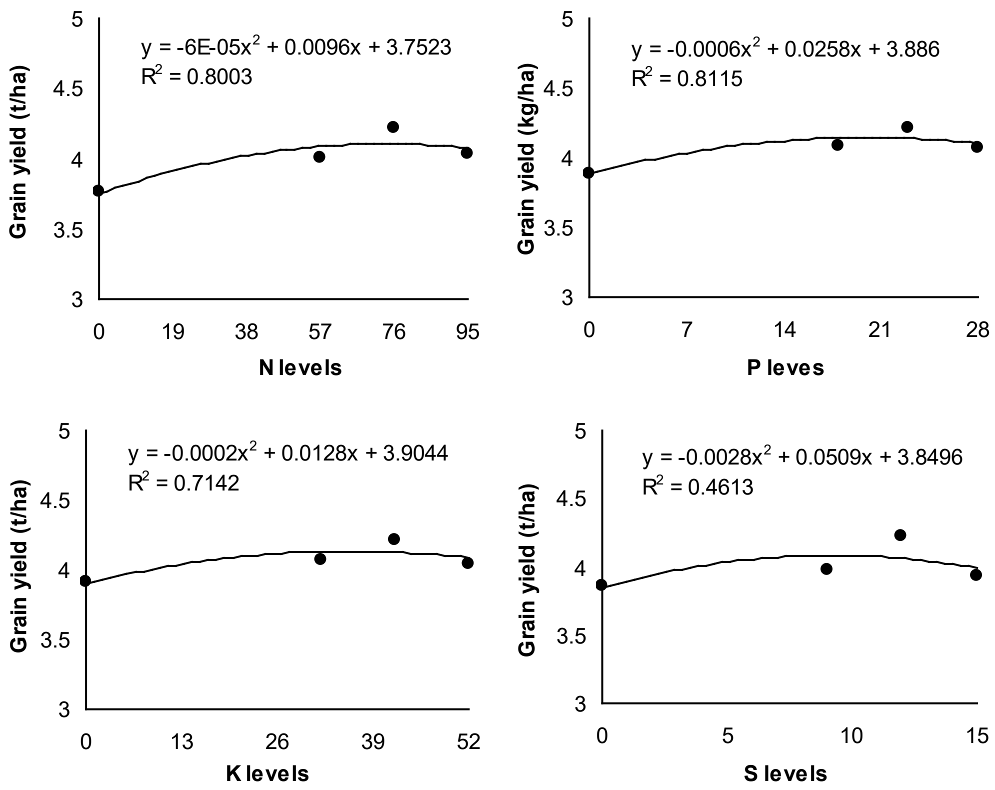


Figure 25. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at Kendua, Kishoregonj during 2000 to 2002

Table 18. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro-T.Aman cropping pattern at Kendua MLT site, Kishoreganj, 2000-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 4.10 | 3.90 | 3.84 | 3.95 |
| 90 | 5.28 | 4.91 | 5.32 | 5.17 |
| 125 | 5.46 | 5.49 | 5.72 | 5.36 |
| 160 | 5.15 | 5.09 | 5.40 | 5.21 |
| P (Levels) | | | | |
| 0 | 4.96 | 4.83 | 5.28 | 5.02 |
| 26 | 5.32 | 5.28 | 5.36 | 5.32 |
| 36 | 5.46 | 5.49 | 5.72 | 5.56 |
| 46 | 5.18 | 5.27 | 5.44 | 5.30 |
| K (Levels) | | | | |
| 0 | 5.03 | 4.96 | 5.24 | 5.08 |
| 46 | 5.31 | 5.26 | 5.24 | 5.27 |
| 64 | 5.46 | 5.49 | 5.72 | 5.56 |
| 82 | 5.25 | 5.28 | 5.24 | 5.26 |
| S (Levels) | | | | |
| 0 | 4.71 | 4.90 | 4.92 | 4.84 |
| 16 | 5.15 | 5.23 | 5.16 | 5.18 |
| 22 | 5.46 | 5.49 | 5.72 | 5.56 |
| 28 | 5.13 | 5.28 | 5.44 | 5.28 |

Table 19. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro-T.Aman cropping pattern at Kendua MLT site, Kishoreganj, 2000-2002

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 3.27 | 4.56 | 3.45 | 3.76 |
| 57 | 3.68 | 4.67 | 3.69 | 4.01 |
| 76 | 4.02 | 4.87 | 3.76 | 4.22 |
| 95 | 3.70 | 4.68 | 3.72 | 4.03 |
| P (Levels) | | | | |
| 0 | 3.60 | 4.72 | 3.36 | 3.89 |
| 18 | 3.75 | 4.81 | 3.70 | 4.09 |
| 23 | 4.02 | 4.87 | 3.76 | 4.22 |
| 28 | 3.78 | 4.76 | 3.68 | 4.07 |
| K (Levels) | | | | |
| 0 | 3.52 | 4.68 | 3.53 | 3.91 |
| 32 | 3.80 | 4.79 | 3.62 | 4.07 |
| 42 | 4.02 | 4.87 | 3.76 | 4.22 |
| 52 | 3.85 | 4.79 | 3.50 | 4.05 |
| S (Levels) | | | | |
| 0 | 3.46 | 4.48 | 3.64 | 3.86 |
| 9 | 3.85 | 4.65 | 3.43 | 3.98 |
| 12 | 4.02 | 4.87 | 3.76 | 4.22 |
| 15 | 3.81 | 4.57 | 3.40 | 3.93 |

**Location : Syedpur FSRD site, Rangpur**
**Year of establishment: 1999-2000 to 2001-02**

**Boro**

Average of three years data showed that in Boro rice, grain yield increased markedly with the increase of nitrogen up to 110 kg/ha of N and after that level yield decline. As the soil was deficit in N and therefore response of added nitrogen was evident in the grain yield of Boro rice. Similarly, in case of P a sharp and positive response was evident and grain yield increased up to the application of 26 kg/ha of P. However, regarding K and S the response was not so evident but yield increased slowly up to 48 and 3 kg/ha of K and S, respectively.

**T.Aman**

In T.Aman rice, almost similar trend like Boro rice was found. Grain yield increased markedly with the addition of N and highest yield was obtained from the application of 90 kg/ha of N. Similarly, a positive response to P and K was found. Grain yield increased rapidly up to 15 and 28 kg/ha of P and K. After that the rate of increment was slow. Yield increased up to the application of 20 and 36 kg/ha of P and K, respectively. But in case of S the response was not very sharp but yield increased slowly up to 3 kg/ha of S.

From the response curve a quadratic relationship was observed and the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 132 | 35 | 48 | 3 | - | - | - | - |
| T.Aman | 99 | 23 | 40 | 4 | - | - | - | - |

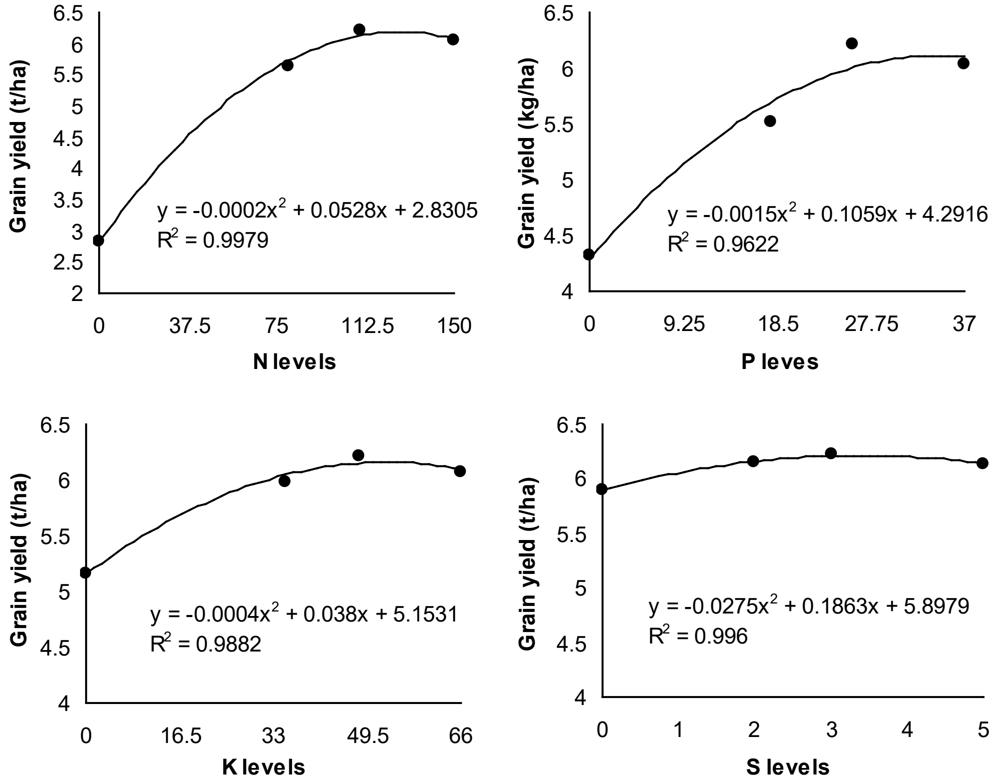


Figure 26. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at Syedpur during 2000 to 2002

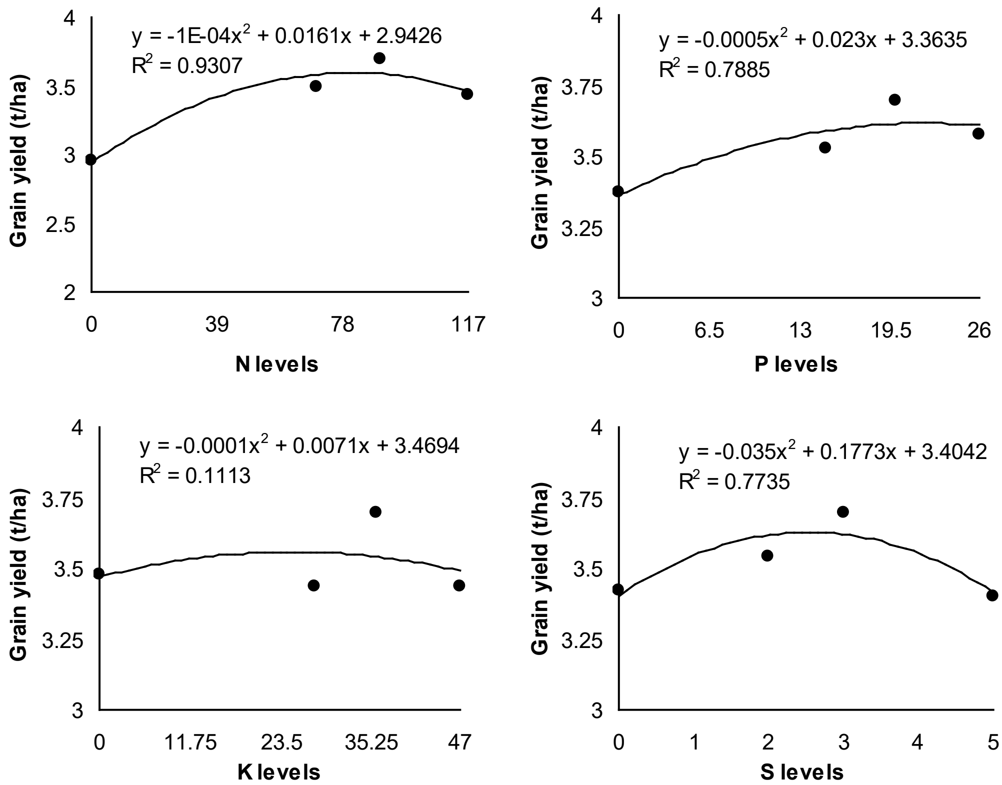


Figure 27. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at Syedpur during 2000 to 2002

Table 20. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro-T.Aman cropping pattern at Syedpur FSRD site, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.95c | 2.81c | 2.77c | 2.84 |
| 80 | 5.68b | 5.76b | 5.51b | 5.65 |
| 110 | 6.39a | 6.22a | 6.05a | 6.22 |
| 150 | 6.23a | 6.07a | 5.86a | 6.05 |
| P (Levels) | | | | |
| 0 | 4.47c | 4.31c | 4.18c | 4.32 |
| 18 | 5.78b | 5.49b | 5.29b | 5.52 |
| 26 | 6.39a | 6.22a | 6.05a | 6.22 |
| 37 | 6.24ab | 6.00a | 5.88a | 6.04 |
| K (Levels) | | | | |
| 0 | 5.28b | 5.17b | 5.02b | 5.16 |
| 35 | 6.10a | 6.01a | 5.86a | 5.99 |
| 48 | 6.39a | 6.22a | 6.05a | 6.22 |
| 66 | 6.25a | 6.10a | 5.90a | 6.08 |
| S (Levels) | | | | |
| 0 | 6.02a | 5.89a | 5.78a | 5.90 |
| 2 | 6.28a | 6.15a | 6.02a | 6.15 |
| 3 | 6.39a | 6.22a | 6.05a | 6.22 |
| 5 | 6.32a | 6.12a | 5.98a | 6.14 |

Table 21. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro-T.Aman cropping pattern at Syedpur FSRD site, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.16c | 2.25c | 2.20c | 2.20 |
| 70 | 4.82b | 5.01b | 4.91b | 4.91 |
| 90 | 5.32a | 5.53a | 5.46a | 5.44 |
| 117 | 5.26a | 5.43a | 5.37a | 5.35 |
| P (Levels) | | | | |
| 0 | 3.86b | 3.96b | 3.77b | 3.86 |
| 15 | 5.10a | 5.24a | 5.19a | 5.18 |
| 20 | 5.32a | 5.53a | 5.46a | 5.44 |
| 26 | 5.26a | 5.46a | 5.38a | 5.37 |
| K (Levels) | | | | |
| 0 | 4.08b | 4.23b | 4.10b | 4.14 |
| 28 | 5.23a | 5.37a | 5.33a | 5.31 |
| 36 | 5.32a | 5.53a | 5.46a | 5.44 |
| 47 | 5.28a | 5.50a | 5.43a | 5.40 |
| S (Levels) | | | | |
| 0 | 4.55b | 4.68b | 4.54b | 4.59 |
| 2 | 5.20a | 5.35a | 5.22a | 5.26 |
| 3 | 5.32a | 5.53a | 5.46a | 5.44 |
| 5 | 5.25a | 5.42a | 5.34a | 5.34 |

**Location : Polashbari, Rangpur**
**Year of establishment: 1999-2000 to 2001-02**

**Boro**

From the Mean data it was observed that in Boro rice, grain yield increased markedly with the increase of nitrogen up to 100 kg N/ha and after that level the rate of increment was slow. Yield increased up to the application of 140 kg/ha of N and thereafter started to reduce. In case of P and K a slow but positive response was found and the yield increased up to the application of 24 and 79 kg kg/ha of P and K, respectively. A positive response to sulphur was also observed to some extent and grain yield increased up to 19 kg/ha of S.

**T.Aman**

In T.Aman rice, almost similar trend like Boro rice was found. Grain yield of T.Aman rice increased sharply up to the application of 90 kg/ha of N and then slowly increased up to 117 kg/ha. After that level yield was started to decrease. Response of T.Aman rice to PKS was also observed to some extent. Yield increased slowly up to the application of 20, 60 and 15 kg/ha of PKS, respectively.

From the response curve a quadratic relationship was observed and the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 113 | 28 | 84 | 23 | - | - | - | - |
| T.Aman | 113 | 17 | 52 | 16 | - | - | - | - |

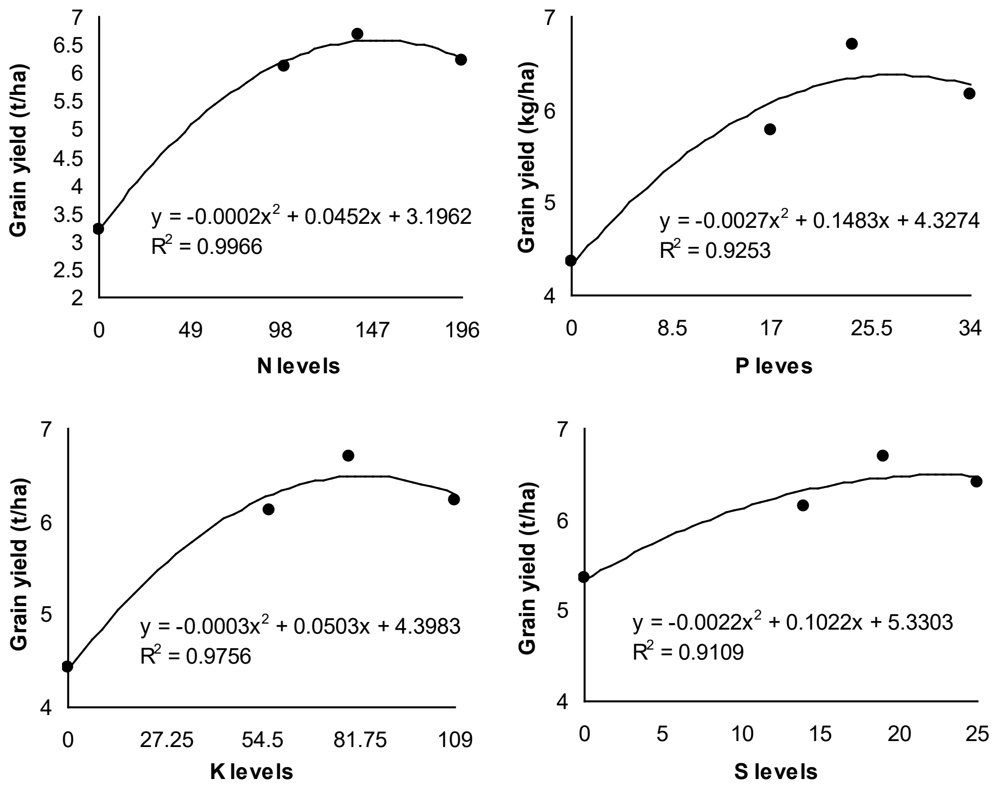


Figure 27. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Polashbari during 2000 to 2002

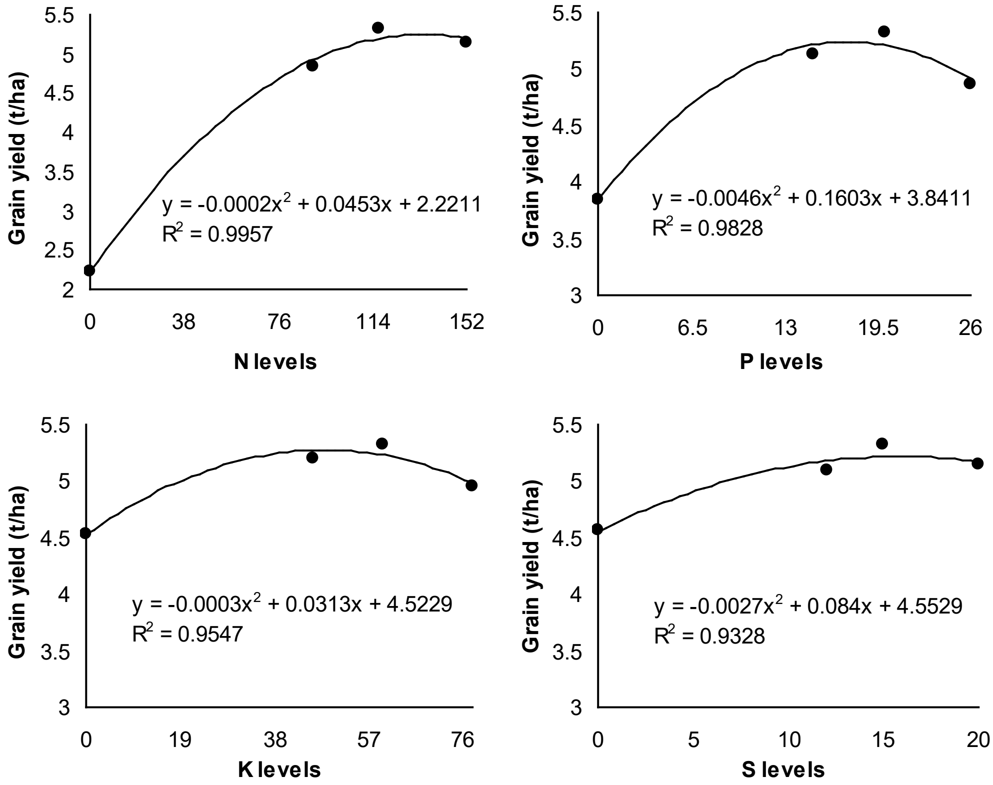


Figure 28. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Polashbari during 2000 to 2002

Table 22. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro-T.Aman cropping pattern at Polashbari, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 3.12c | 3.16c | 3.36c | 3.21 |
| 100 | 6.17b | 6.05b | 6.12b | 6.11 |
| 140 | 6.63a | 6.69a | 6.75a | 6.69 |
| 196 | 6.30ab | 6.19ab | 6.21ab | 6.23 |
| P (Levels) | | | | |
| 0 | 4.30c | 4.37c | 4.43c | 4.37 |
| 17 | 5.74b | 5.75b | 5.84b | 5.78 |
| 24 | 6.63a | 6.69a | 6.75a | 6.69 |
| 34 | 6.09a | 6.20a | 6.20ab | 6.16 |
| K (Levels) | | | | |
| 0 | 4.31c | 4.42c | 4.54c | 4.42 |
| 57 | 6.06b | 6.10b | 6.19b | 6.12 |
| 79 | 6.63a | 6.69a | 6.75a | 6.69 |
| 109 | 6.15b | 6.23ab | 6.32ab | 6.23 |
| S (Levels) | | | | |
| 0 | 5.28c | 5.34c | 5.42c | 5.35 |
| 14 | 6.10b | 6.14b | 6.21b | 6.15 |
| 19 | 6.63a | 6.69a | 6.75a | 6.69 |
| 25 | 6.30ab | 6.40ab | 6.49ab | 6.40 |

Table 23. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro-T.Aman cropping pattern at Polashbari, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.25c | 2.15c | 2.28c | 2.23 |
| 90 | 5.00b | 4.71b | 4.77b | 4.83 |
| 117 | 5.46a | 5.19a | 5.33a | 5.33 |
| 152 | 5.29a | 5.02a | 5.13ab | 5.15 |
| P (Levels) | | | | |
| 0 | 3.95b | 3.69b | 3.92c | 3.85 |
| 15 | 5.27a | 4.96a | 5.16ab | 5.13 |
| 20 | 5.46a | 5.19a | 5.33a | 5.33 |
| 26 | 5.02a | 4.78a | 4.82b | 4.87 |
| K (Levels) | | | | |
| 0 | 4.64b | 4.39b | 4.56b | 4.53 |
| 46 | 5.36a | 5.05a | 5.18ab | 5.20 |
| 60 | 5.46a | 5.19a | 5.33a | 5.33 |
| 78 | 5.07ab | 4.84ab | 4.94ab | 4.95 |
| S (Levels) | | | | |
| 0 | 4.72b | 4.44b | 4.52b | 4.56 |
| 12 | 5.21a | 4.96a | 5.11a | 5.09 |
| 15 | 5.46a | 5.19a | 5.33a | 5.33 |
| 20 | 5.28a | 4.98a | 5.15a | 5.14 |

**Location : Nilphamari, Rangpur**
**Year of establishment: 1999-2000 to 2001-02**

**Boro**

From the Mean data it was observed that in Boro rice, grain yield increased sharply with the increase of nitrogen up to 100 kg /ha of N and after that level the rate of increment was slow. Yield increased up to the application of 140 kg/ha of N and thereafter started to reduce. In case of P and S a slow but positive response was found and the yield increased up to the application of 14 and 68 kg kg/ha of P and K, respectively. A positive response to sulphur was also observed to some extent and grain yield increased up to 14 kg/ha of S.

**T.Aman**

In T.Aman rice, almost similar trend like Boro rice was found. Grain yield of T.Aman rice increased sharply up to the application of 90 kg/ha of N and then slowly increased up to 117 kg/ha. After that level yield was started to decrease. Response of T.Aman rice to PKS was also observed to some extent. Yield increased slowly up to the application of 10, 52 and 10 kg/ha of PKS, respectively.

From the response curve a quadratic relationship was observed and the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 208 | 18 | 78 | 17 | - | - | - | - |
| T.Aman | 122 | 9 | 38 | 8 | - | - | - | - |

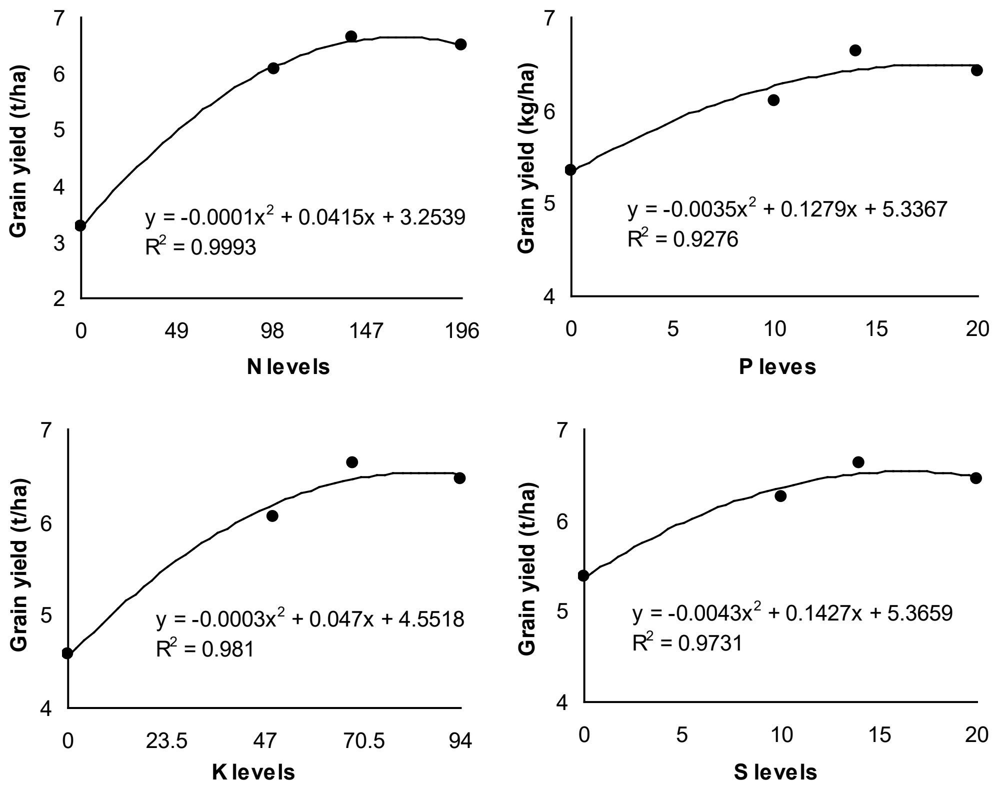


Figure 29. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Nilphamari during 2000 to 2002

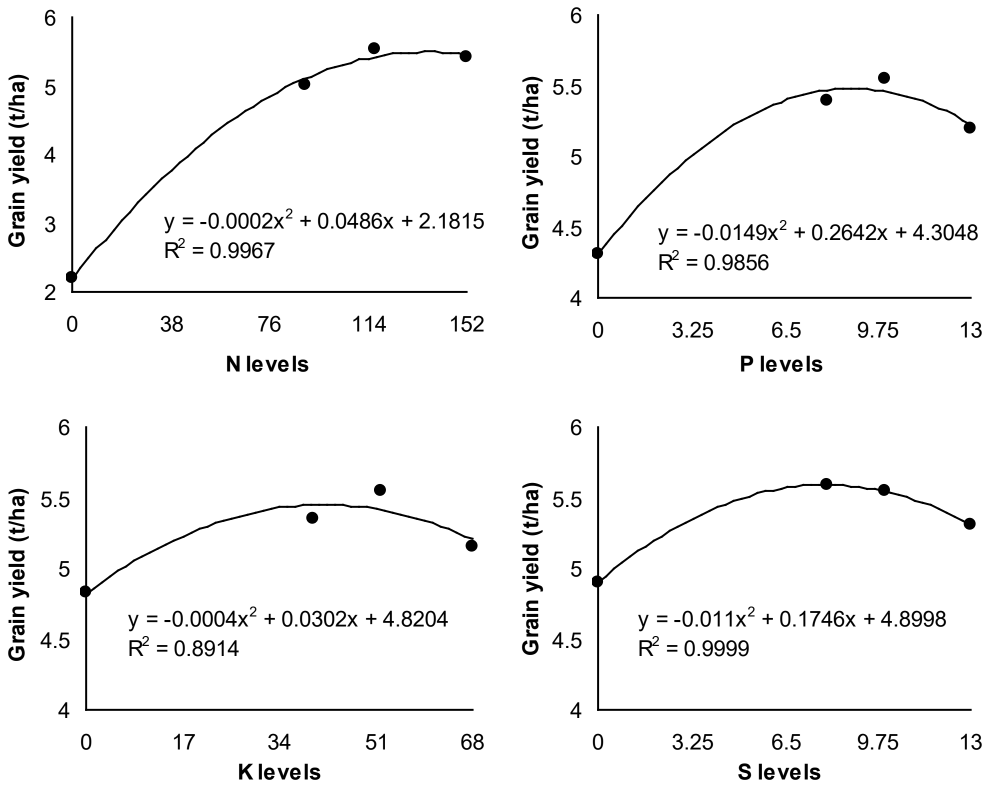


Figure 30. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Nilphamari during 2000 to 2002

Table 24. Effects of different levels of fertilizer nutrients on the yield of Boro rice in Boro-T.Aman cropping pattern at Nilphamari, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 3.20c | 3.31c | 3.26c | 3.26 |
| 100 | 6.10b | 6.15b | 6.03b | 6.09 |
| 140 | 6.52a | 6.72a | 6.65a | 6.63 |
| 196 | 6.40a | 6.61a | 6.50a | 6.50 |
| P (Levels) | | | | |
| 0 | 5.28b | 5.43b | 5.37b | 5.36 |
| 10 | 5.98a | 6.20a | 6.12a | 6.10 |
| 14 | 6.52a | 6.72a | 6.65a | 6.63 |
| 20 | 6.32a | 6.50a | 6.46a | 6.43 |
| K (Levels) | | | | |
| 0 | 4.41c | 4.70c | 4.61c | 4.57 |
| 49 | 5.90b | 6.17b | 6.08b | 6.05 |
| 68 | 6.52a | 6.72a | 6.65a | 6.63 |
| 94 | 6.38ab | 6.53ab | 6.46ab | 6.46 |
| S (Levels) | | | | |
| 0 | 5.24b | 5.52b | 5.39b | 5.38 |
| 10 | 6.21a | 6.33a | 6.25a | 6.26 |
| 14 | 6.52a | 6.72a | 6.65a | 6.63 |
| 20 | 6.39a | 6.54a | 6.42a | 6.45 |

Table 25. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Boro-T.Aman cropping pattern at Nilphamari, Rangpur, 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000 | 2001 | 2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.18c | 2.27c | 2.11c | 2.19 |
| 90 | 5.06b | 5.16b | 4.84b | 5.02 |
| 117 | 5.49a | 5.70a | 5.45a | 5.55 |
| 152 | 5.32a | 5.52a | 5.39a | 5.41 |
| P (Levels) | | | | |
| 0 | 4.28b | 4.43b | 4.23b | 4.31 |
| 8 | 5.38a | 5.57a | 5.26a | 5.40 |
| 10 | 5.49a | 5.70a | 5.45a | 5.55 |
| 13 | 5.16a | 5.31a | 5.13a | 5.20 |
| K (Levels) | | | | |
| 0 | 4.78c | 4.93b | 4.78b | 4.83 |
| 40 | 5.31ab | 5.51a | 5.24a | 5.35 |
| 52 | 5.49a | 5.70a | 5.45a | 5.55 |
| 68 | 5.11bc | 5.29ab | 5.08ab | 5.16 |
| S (Levels) | | | | |
| 0 | 4.86b | 4.99b | 4.84b | 4.90 |
| 8 | 5.52a | 5.77a | 5.48a | 5.59 |
| 10 | 5.49a | 5.70a | 5.45a | 5.55 |
| 13 | 5.29 | 5.46a | 5.19ab | 5.31 |

**Location : Kolaroa MLT site, Khulna**
**Year of establishment : 2001-02**

**Boro**

A positive response of Boro rice was noticed to NPKS nutrients. Grain yield was increased with the increase of N levels up to 140 kg/ha of N and after that level started to decrease. Similarly, in case of P, K and S and yield increased up to the application of 35 kg/ha, 20 kg/ha and 20 kg/ha of P, K and S, respectively.

**T.Aman**

Similar trend was found like Boro rice. Grain yield increased with the increase of N and the highest yield was obtained from 95 kg/ha of N. In case of P, K and S a positive response was also observed and grain yield increased up to the application of 20 kg/ha, 15 kg/ha and 15 kg/ha of P, K and S, respectively. A response curve was drawn from the yield data and a quadratic type of relationship was found.

From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 139 | 26 | 20 | 19 | - | - | - | - |
| T.Aman | 97 | 17 | 16 | 15 | - | - | - | - |

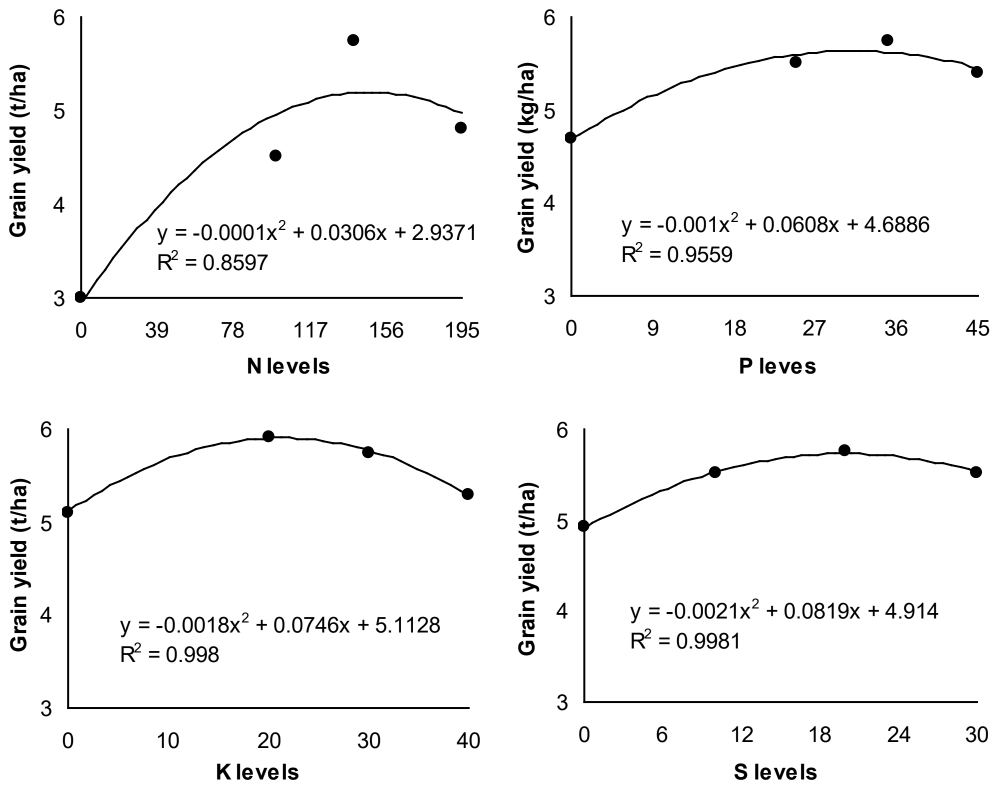


Figure 31. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Kolaroa, Khulna during 2000-01

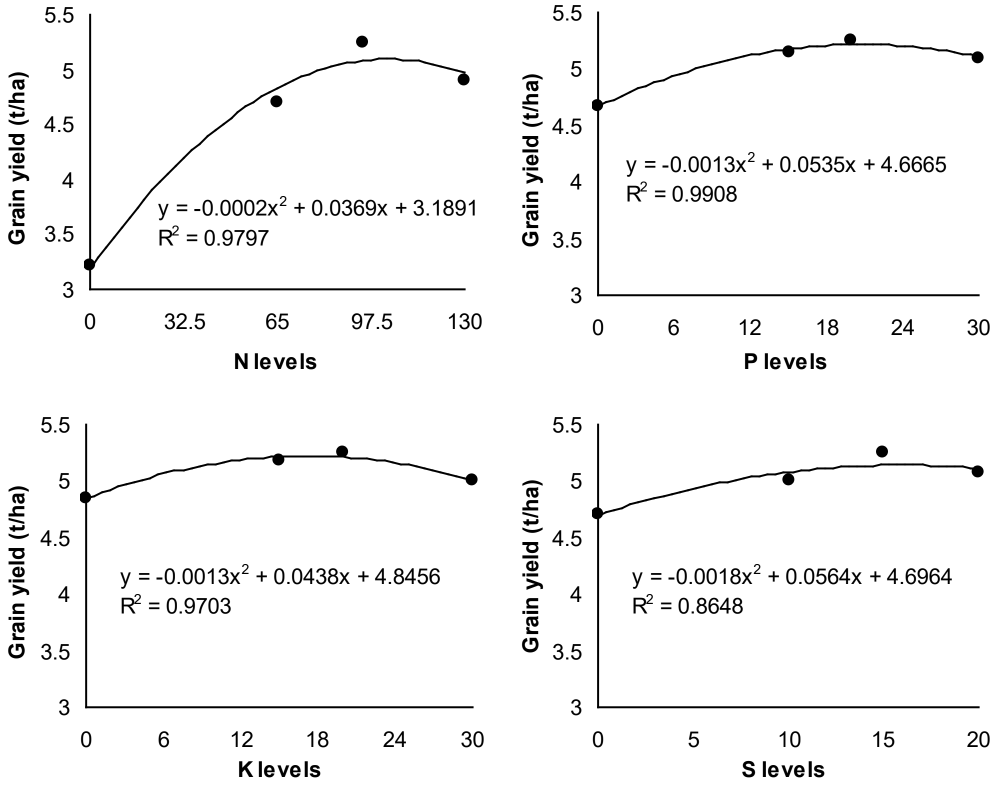


Figure 32. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Kolaroa, Khulna during 2001-02

Table 26. Effects of different levels of fertilizer nutrients on the yield of crops Boro-T.Aman cropping pattern at Kolaroa MLT site, Khulna, 2001-02

| Nutrient levels (kg/ha) | | Grain yield(t/ha) | |
|---|---|---|---|
| Boro | T.Aman | Boro | T.Aman |
| N levels | | | |
| 0 | 0 | 3.00 | 3.21 |
| 100 | 65 | 4.51 | 4.70 |
| 140 | 95 | 5.75 | 5.25 |
| 195 | 130 | 4.80 | 4.91 |
| P levels | | | |
| 0 | 0 | 4.70 | 4.67 |
| 25 | 15 | 5.51 | 5.15 |
| 35 | 20 | 5.75 | 5.25 |
| 45 | 30 | 5.40 | 5.10 |
| K levels | | | |
| 0 | 0 | 5.11 | 4.85 |
| 20 | 15 | 5.92 | 5.18 |
| 30 | 20 | 5.75 | 5.25 |
| 40 | 30 | 5.30 | 5.00 |
| S levels | | | |
| 0 | 0 | 4.92 | 4.71 |
| 10 | 10 | 5.51 | 5.00 |
| 20 | 15 | 5.75 | 5.25 |
| 30 | 20 | 5.52 | 5.07 |

**Location : Feni, Noakhali**
**Year of establishment : 2001-02**

### Boro

A positive response of Boro rice was noticed to N. Grain yield was increased with the increase of N levels sharply up to 130 kg/ha of N and after that level started to decrease. Similarly, in case of P, K and S a positive response was found to some extent. Grain yield increased appreciably up to the application of 30 kg/ha, 80 kg/ha and 20 kg/ha of P, K and S, respectively.

### T.Aman

Similar trend was found like Boro rice. Grain yield increased with the increase of N and the highest yield was obtained from 120 kg/ha of N. However, the rate of increment was higher up to 90 kg/ha. In case of P, K and S a positive response was also observed and grain yield increased appreciably up to the application of 24 kg/ha, 60 kg/ha and 16 kg/ha of P, K and S, respectively. A response curve was drawn from the yield data and a quadratic type of relationship was found.

From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 124 | - | 98 | - | - | - | - | - |
| T.Aman | 100 | 17 | 96 | 11 | - | - | - | - |

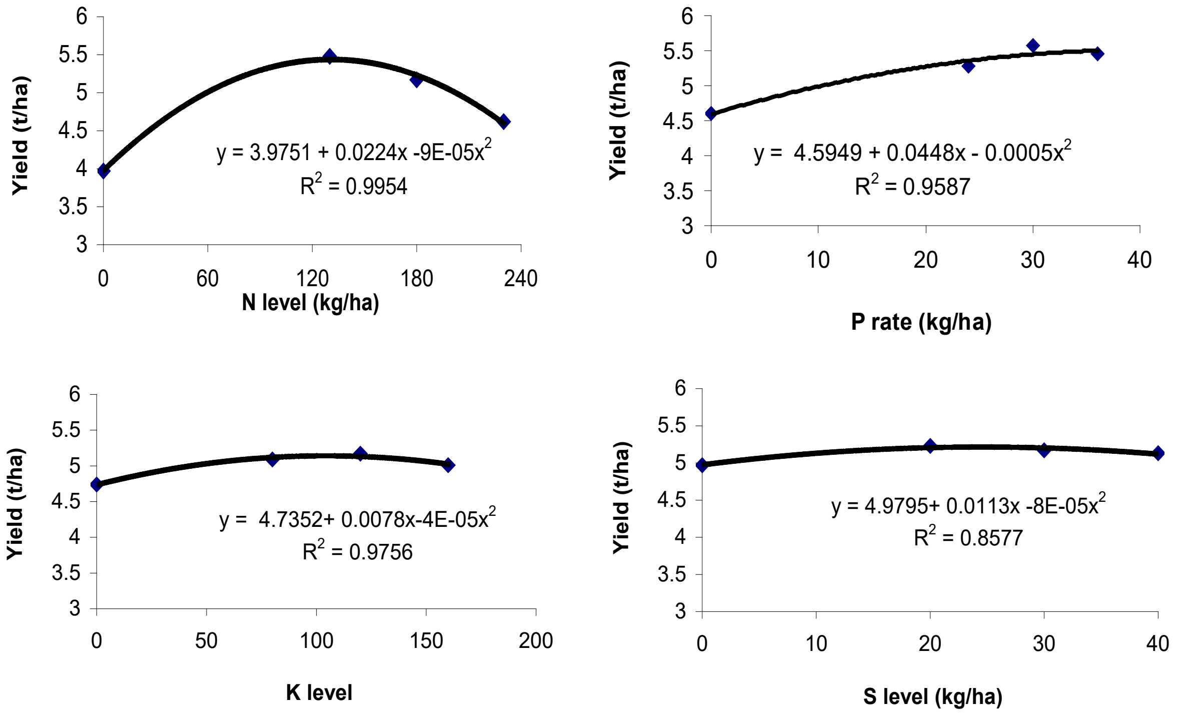


Figure 33. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Dagonbhuiyan, Feni, 2002

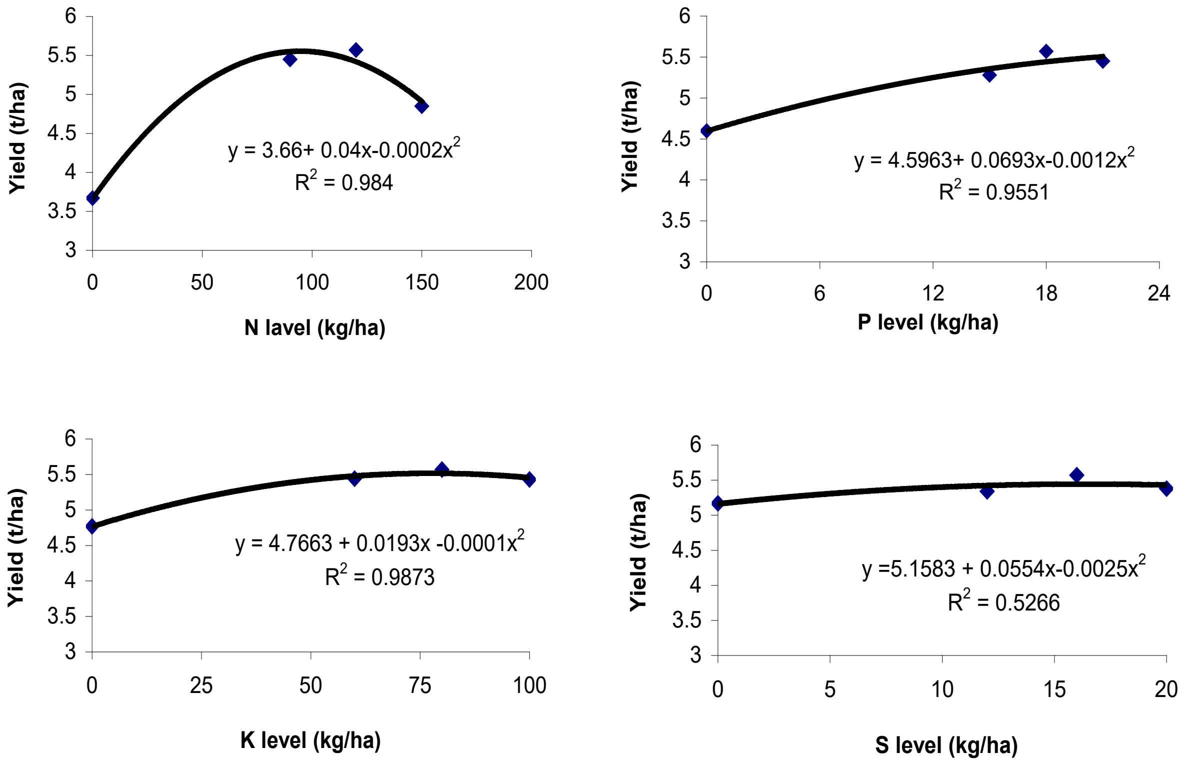


Figure 34. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Dagonbhuiyan, Feni, 2002

Table 27. Effects of different levels of fertilizer nutrients on the yield of crops Boro-T.Aman cropping pattern at Feni, Noakhali, 2001-02

| Nutrient levels (kg/ha) | | Grain yield | |
|---|---|---|---|
| Boro | T.Aman | Boro (t/ha) | T.Aman (t/ha) |
| N levels | | | |
| 0 | 0 | 3.97 | 3.67 |
| 130 | 90 | 5.48 | 5.45 |
| 180 | 120 | 5.17 | 5.57 |
| 230 | 150 | 4.62 | 4.85 |
| P levels | | | |
| 0 | 0 | 4.59 | 4.60 |
| 30 | 24 | 5.10 | 5.28 |
| 50 | 30 | 5.17 | 5.57 |
| 70 | 36 | 5.05 | 5.45 |
| K levels | | | |
| 0 | 0 | 4.74 | 4.77 |
| 80 | 60 | 5.09 | 5.44 |
| 120 | 80 | 5.17 | 5.57 |
| 160 | 100 | 5.01 | 5.43 |
| S levels | | | |
| 0 | 0 | 4.97 | 5.17 |
| 20 | 12 | 5.23 | 5.34 |
| 30 | 16 | 5.17 | 5.57 |
| 40 | 20 | 5.13 | 5.38 |

**Location : Hathazari, Chittagong**
**Year of establishment : 1999-2000 to 2001-02**

### Boro

Average of three years data showed that Boro rice responded positively to different added nutrients. Grain yield increased markedly up to 100 kg/ha of N and then the rate of increment was not very sharp. However, yield increased up to 140 kg/ha. Similarly, in case of P, K and S a positive response was found and yield increased sharply up to 25, 69 and 13 kg/ha of P, K and S, respectively. For P and k the yield increased very slowly up to 36 and 97 kg/ha of P and K, respectively.

### T.Aman

Similar trend was found in T.Aman rice like Boro rice. Grain yield increased with the increase of N and the highest yield was obtained from 93 kg/ha of N. However, the rate of increment was higher up to 68 kg/ha. In case of P, K and S a positive response was also observed and grain yield increased appreciably up to the application of 18 kg/ha, 49 kg/ha and 8 kg/ha of P, K and S, respectively. But the trend was increasing up to 22, 62 and 10 kg/ha of P, K and S, respectively.

From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 148 | 34 | 113 | 21 | - | - | - | - |
| T.Aman | 84 | 24 | 68 | 13 | - | 6 | 39 | 12 |

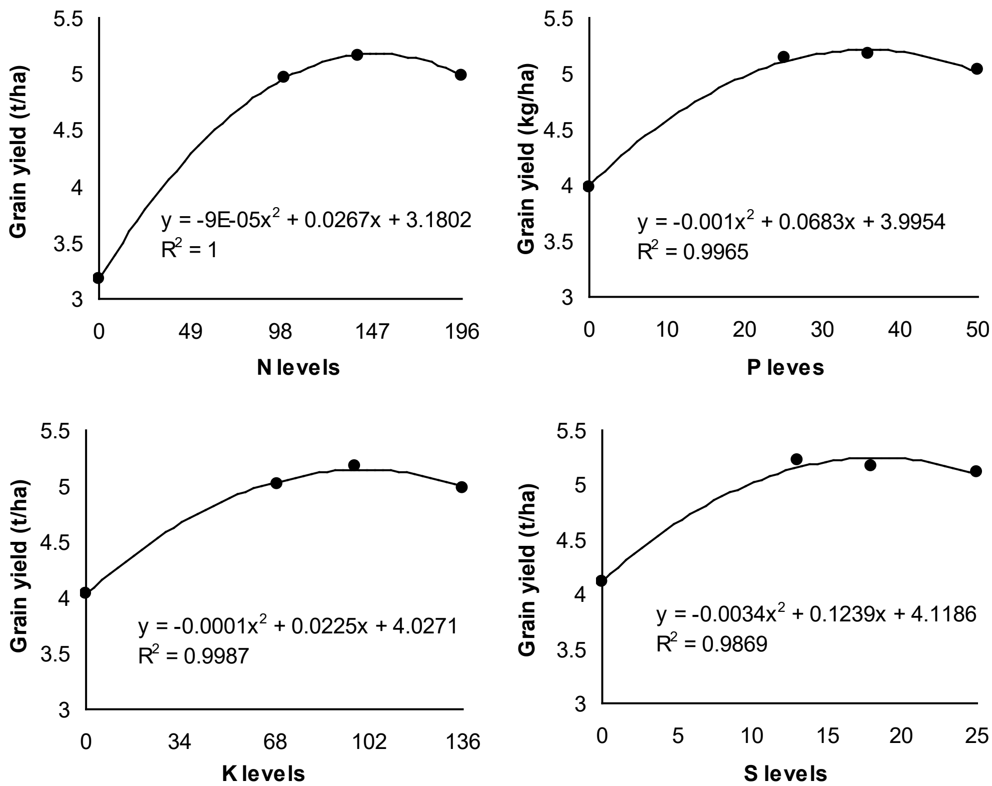


Figure 35. Response of Boro rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Hathazari, Chittagong 2000 to 2002

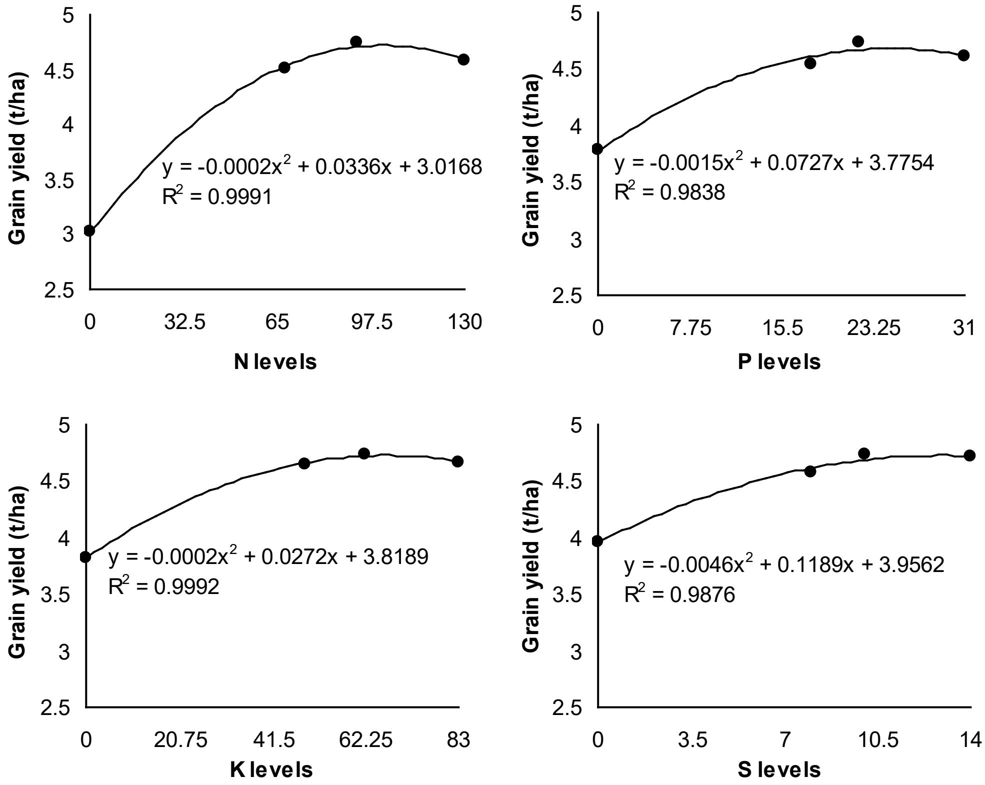


Figure 36. Response of T.Aman rice to NPKS grown in Boro-T.Aman cropping pattern at MLT site, Hathazari, Chittagong 2000 to 2002

Table 28. Effects of different levels of fertilizer nutrients on the yield of crops Boro-T.Aman cropping pattern at Hathazari, Chittagong during 1999-2000 to 2001-02 (Avg. of 3 years)

| Nutrient levels (kg/ha) | | Grain yield | |
|---|---|---|---|
| Boro | T.Aman | Boro (t/ha) | T.Aman (t/ha) |
| N levels | | | |
| 0 | 0 | 3.18 | 3.02 |
| 100 | 68 | 4.96 | 4.51 |
| 140 | 93 | 5.17 | 4.74 |
| 196 | 130 | 4.99 | 4.58 |
| P levels | | | |
| 0 | 0 | 3.99 | 3.78 |
| 25 | 18 | 5.14 | 4.55 |
| 36 | 22 | 5.17 | 4.74 |
| 50 | 31 | 5.03 | 4.61 |
| K levels | | | |
| 0 | 0 | 4.03 | 3.82 |
| 69 | 49 | 5.02 | 4.65 |
| 97 | 62 | 5.17 | 4.74 |
| 136 | 83 | 4.99 | 4.67 |
| S levels | | | |
| 0 | 0 | 4.11 | 3.96 |
| 13 | 8 | 5.22 | 4.57 |
| 18 | 10 | 5.17 | 4.74 |
| 25 | 14 | 5.12 | 4.71 |

**Location : Ishan Gopalpur, Faridpur**
**Year of establishment : 2001-02**

### Boro

Grain yield increased up to 90 kg/ha of N and thereafter tended to decrease. Similarly, in case of P and S a positive response was found and yield increased up to 24 and 16 kg/ha of P and S, respectively.

### T.Aman

Similar trend was found in T.Aman rice like Boro rice. Grain yield increased with the increase of N up to 60 kg/ha. In case of P and S a positive response was also observed and grain yield increased up to the application of 16 kg/ha and 12 kg/ha of P and S, respectively.

From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Boro | 110 | 26 | 32 | 17 | - | - | - | - |
| T.Aman | 73 | 12 | 16 | 9 | - | - | - | - |

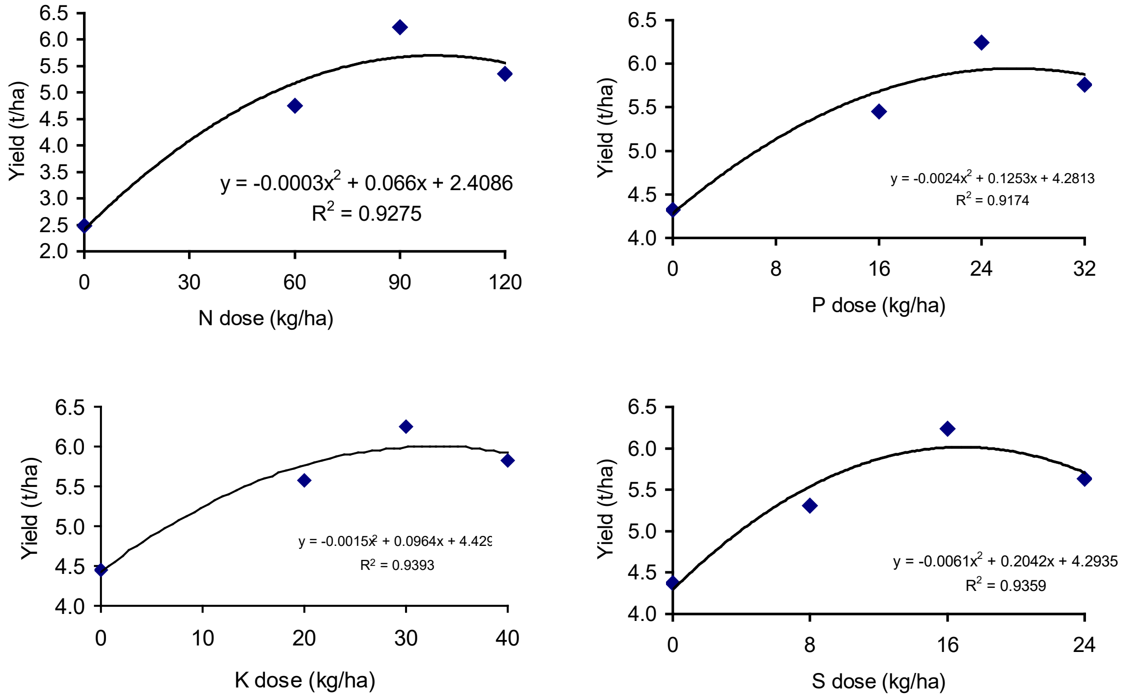


Figure 37. Response of Boro rice to NPKS grown in Boro-T.Aman rice cropping pattern at FSRD site, Ishan Gopalpur, Faridpur during 2001-02

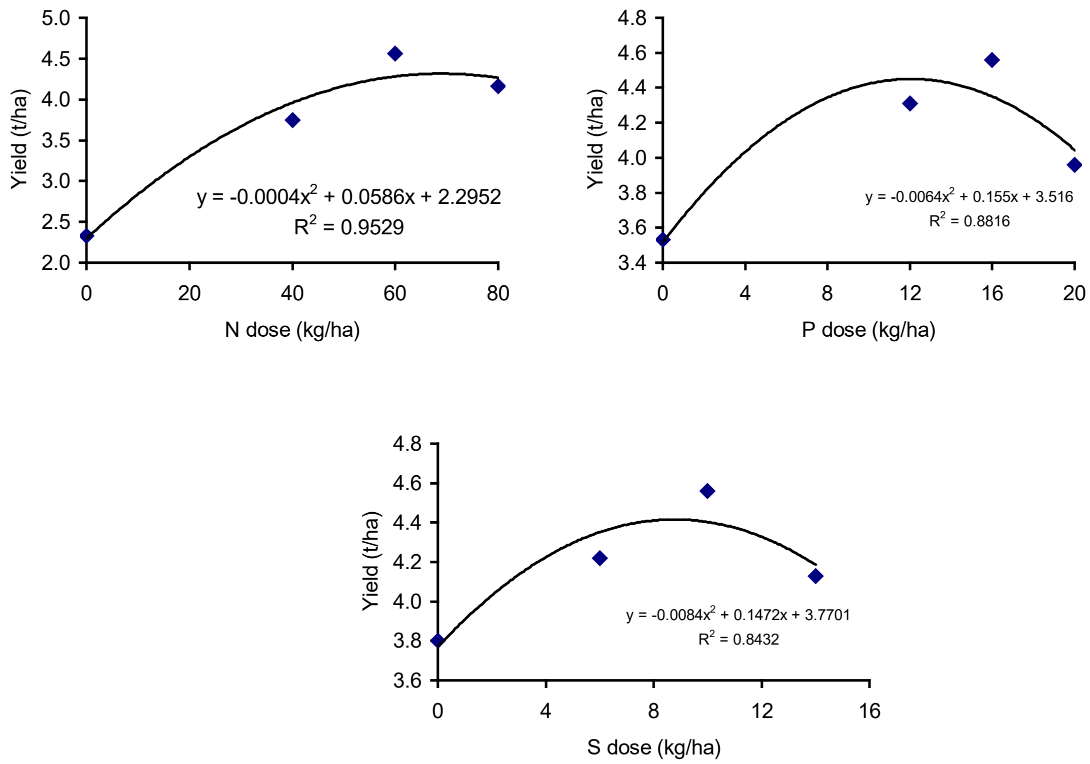


Figure 38. Response of T.Aman rice to NPS grown in Boro-T.Aman rice cropping pattern at FSRD site, Ishan Gopalpur, Faridpur during 2001-02

**Location : Goyeshpur, Pabna**
**Cropping pattern : Wheat - T.Aman**
**Year of establishment : 1999-2000 to 2001-02**

### Wheat

Average of three years data showed that grain yield of Wheat markedly increased up to 70 kg N/ha but the yield increased slowly up to 130 kg N/ha. Phosphorus, Potassium and Sulphur also showed a very small response towards the yield and yield increase up to 30 kg/ha, 50 kg/ha and 25 kg/ha of P K and S, respectively.

### T.Aman

In T.Aman rice, response of N was very distinct and the grain yield increased linearly with the increase of nitrogen level. In case of P, K and S, grain yield increased very slowly up to the application of 20, 20and 10 kg/ha of P, K and S, respectively. However, the overall response of T.Aman rice to P, K and S was not very clear.

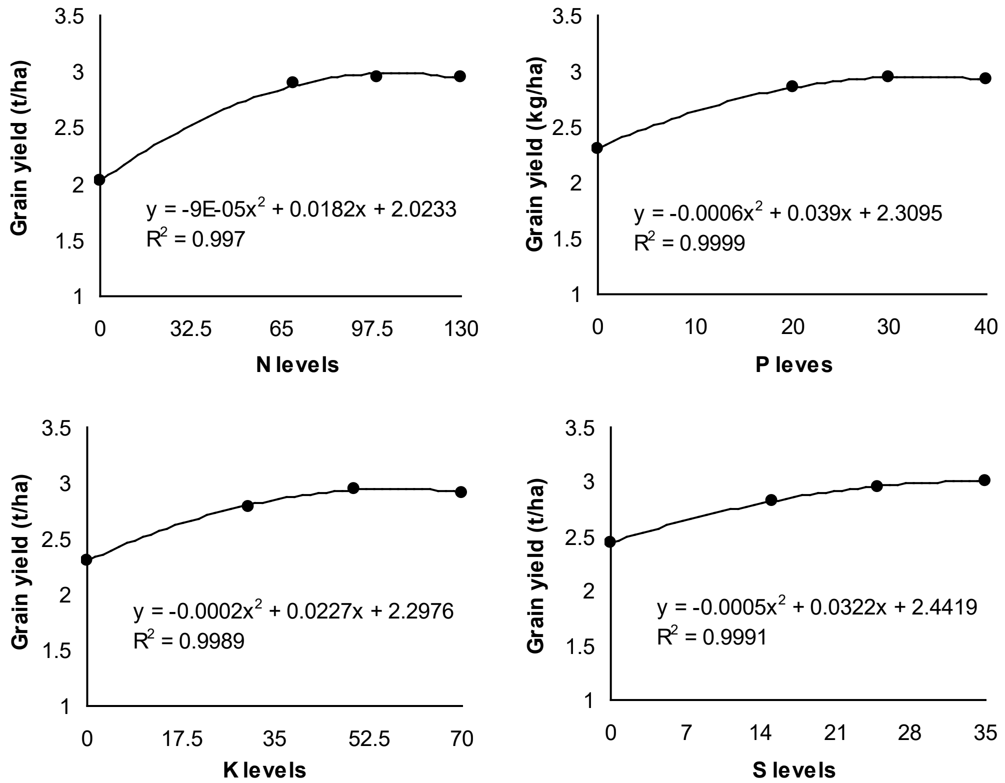


Figure 39. Response of Wheat to NPKS grown in Wheat-T.Aman rice cropping pattern at FSRD site, Goyeshpur, Pabna during 2000 to 2002

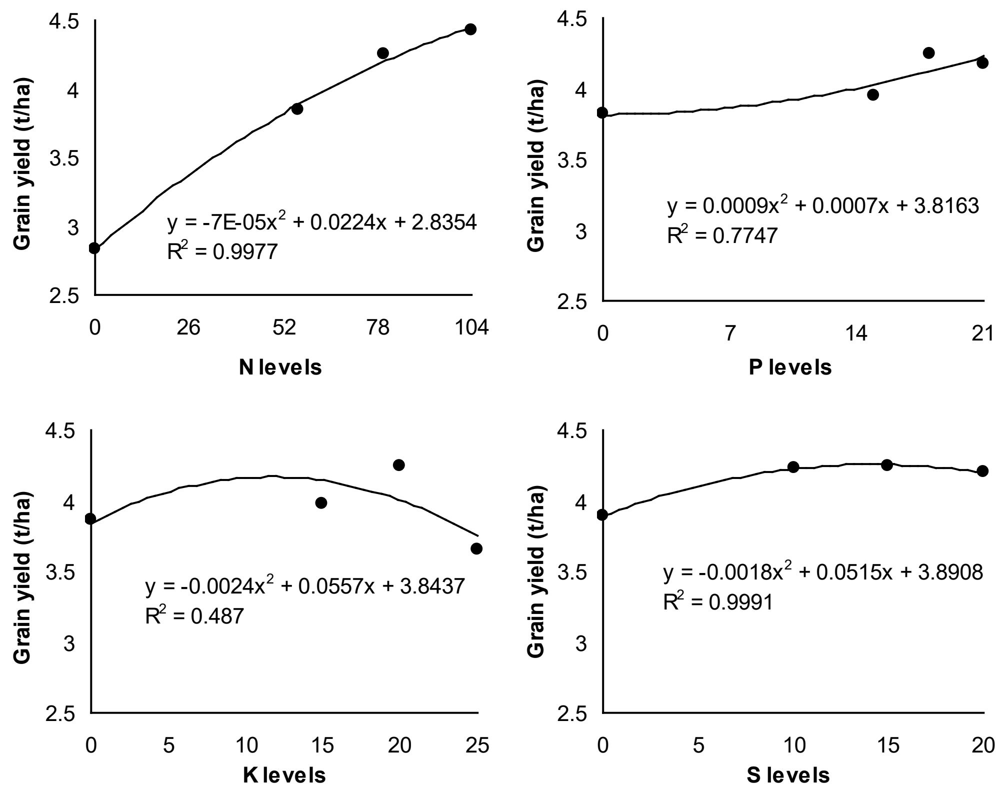


Figure 40. Response of T.Aman rice to NPKS grown in Wheat-T.Aman rice cropping pattern at FSRD site, Goyeshpur, Pabna during 2000 to 2002

Table 29. Effects of different levels of fertilizer nutrients on the yield of Wheat in Wheat-T.Aman cropping pattern at, Goyeshpur, Pabna during 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.34 | 1.58 | 2.15 | 2.02 |
| 70 | 2.35 | 2.47 | 2.88 | 2.90 |
| 100 | 2.96 | 2.93 | 2.96 | 2.95 |
| 130 | 3.08 | 2.61 | 3.15 | 2.95 |
| P levels | | | | |
| 0 | 2.35 | 2.39 | 2.20 | 2.31 |
| 20 | 2.99 | 2.71 | 2.84 | 2.85 |
| 30 | 2.96 | 2.93 | 2.96 | 2.95 |
| 40 | 3.03 | 2.76 | 2.98 | 2.92 |
| K Levels2.40 | | | | |
| 0 | 2.48 | 2.35 | 2.08 | 2.30 |
| 30 | 2.95 | 2.61 | 2.82 | 2.79 |
| 50 | 2.96 | 2.93 | 2.96 | 2.95 |
| 70 | 2.99 | 2.82 | 2.92 | 2.91 |
| S Levels | | | | |
| 0 | 2.55 | 2.44 | 2.33 | 2.44 |
| 15 | 3.00 | 2.66 | 2.84 | 2.83 |
| 25 | 2.99 | 2.93 | 2.96 | 2.95 |
| 35 | 3.39 | 2.69 | 2.94 | 3.01 |

Table 30. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Wheat-T.Aman cropping pattern at Goyeshpur, Pabna during 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| N (Levels) | | | | |
| 0 | 3.21 | 2.35 | 2.95 | 2.84 |
| 56 | 4.05 | 3.70 | 3.79 | 3.85 |
| 80 | 4.38 | 3.99 | 4.38 | 4.25 |
| 104 | 4.69 | 4.55 | 4.04 | 4.43 |
| P (Levels) | | | | |
| 0 | 3.97 | 3.54 | 3.94 | 3.82 |
| 15 | 4.19 | 3.70 | 3.95 | 3.95 |
| 18 | 4.38 | 3.99 | 4.38 | 4.25 |
| 21 | 4.38 | 4.60 | 3.54 | 4.17 |
| K (Levels) | | | | |
| 0 | 4.39 | 3.44 | 3.75 | 3.86 |
| 15 | 4.34 | 3.67 | 3.93 | 3.98 |
| 20 | 4.38 | 3.99 | 4.34 | 4.25 |
| 25 | 3.55 | 3.66 | 3.73 | 3.65 |
| S (Levels) | | | | |
| 0 | 4.45 | 3.63 | 3.58 | 3.89 |
| 10 | 4.67 | 3.95 | 4.06 | 4.23 |
| 15 | 4.38 | 3.99 | 4.34 | 4.25 |
| 20 | 4.44 | 3.99 | 3.79 | 4.20 |

**Location : Barind, Rajshahi**
**Year of establishment: 1999-2000 to 2001-02**

**Wheat**

Average of three years data showed that grain yield of Wheat markedly increased up to 100 kg N/ha and then started to reduce. Phosphorus, Potassium and Sulphur also showed a response towards the yield to some extent. Grain yield increased up to the application of 26 kg, 83 kg and 30 kg/ha of P, K and S respectively.

**T.Aman**

In T.Aman rice, response of N was very distinct up to 100 kg N/ha. After that level tended to reduce. Phosphorus, Potassium and Sulphur also showed some response towards the yield and yield increase up to 18 kg, 20 kg and 9 kg/ha of P, K and S respectively.

Initially the soil was deficient in N, P and S but the response was very evident in case of N for both the crops. However, incase of P and S the response was not very distinct.

From the average data a response curve was drawn and a quadratic relationship was observed. From the response curve the optimum doses of the nutrients for different crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Wheat | 93 | 25 | 79 | 35 | 90 | 24 | 72 | 23 |
| T.Aman | 81 | 17 | 21 | 10 | 79 | 16 | 17 | 9 |

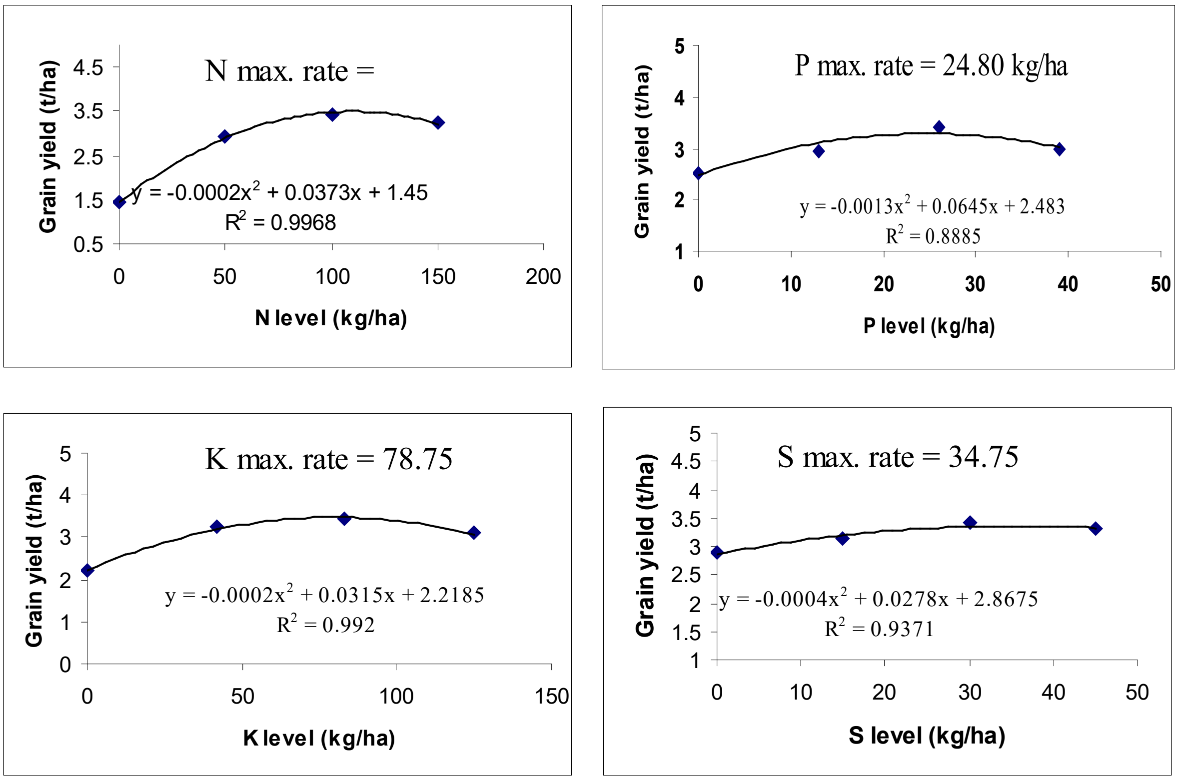


Figure 41. Response of Wheat to NPKS grown in Wheat-T.Aman cropping pattern at FSRD site, Chabbishnagor, Rajshahi during 1999-2002

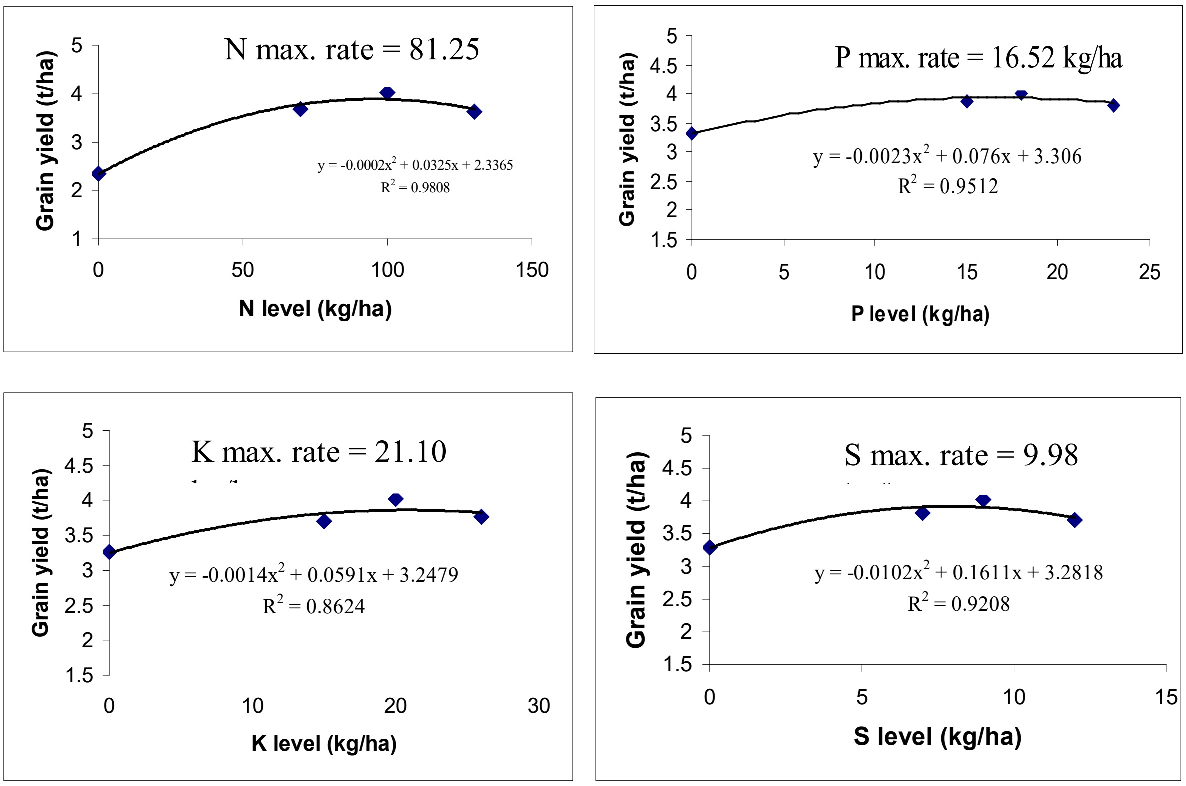


Figure 42. Response of T.Aman to NPKS grown in Wheat-T.Aman cropping pattern at FSRD site, Chabbishnagor, Rajshahi during 1999-2002

Table 31. Effects of different levels of fertilizer nutrients on the yield of Wheat in Wheat -T.Aman cropping pattern at Barind, Rajshahi during 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| N (Levels) | | | | |
| 0 | 1.18 | 1.99 | 1.12 | 1.43 |
| 50 | 2.84 | 3.20 | 1.81 | 2.63 |
| 100 | 3.55 | 3.86 | 2.85 | 3.42 |
| 150 | 3.54 | 3.85 | 2.35 | 3.24 |
| P levels | | | | |
| 0 | 2.83 | 2.94 | 1.84 | 2.53 |
| 13 | 3.16 | 3.58 | 2.16 | 2.96 |
| 26 | 3.55 | 3.86 | 2.85 | 3.42 |
| 39 | 3.28 | 3.69 | 1.95 | 2.97 |
| K Levels | | | | |
| 0 | 3.08 | 3.08 | 2.11 | 2.95 |
| 42 | 3.35 | 3.59 | 2.31 | 3.08 |
| 83 | 3.55 | 3.86 | 2.85 | 3.42 |
| 125 | 3.61 | 3.49 | 2.22 | 3.10 |
| S Levels | | | | |
| 0 | 3.27 | 3.29 | 2.11 | 2.89 |
| 15 | 3.47 | 3.49 | 2.45 | 3.13 |
| 30 | 3.55 | 3.86 | 2.85 | 3.42 |
| 45 | 3.61 | 3.69 | 2.65 | 3.31 |

Table 32. Effects of different levels of fertilizer nutrients on the yield of T.Aman rice in Wheat-T.Aman cropping pattern at Barind, Rajshahi during 1999-2000 to 2001-02

| Fertilizer levels (kg/ha) | Grain yield (t/ha) | | | |
|---|---|---|---|---|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| N (Levels) | | | | |
| 0 | 2.38 | 2.63 | 2.05 | 2.52 |
| 70 | 3.34 | 3.74 | 3.98 | 3.68 |
| 100 | 3.93 | 3.94 | 4.20 | 4.02 |
| 130 | 3.49 | 3.83 | 3.57 | 3.63 |
| P levels | | | | |
| 0 | 3.07 | 3.73 | 3.15 | 3.31 |
| 15 | 3.43 | 4.26 | 3.89 | 3.86 |
| 18 | 3.93 | 3.94 | 4.20 | 4.02 |
| 23 | 3.47 | 3.97 | 4.00 | 3.81 |
| K Levels | | | | |
| 0 | 3.07 | 3.66 | 3.05 | 3.26 |
| 15 | 3.29 | 3.85 | 3.97 | 3.70 |
| 20 | 3.93 | 3.94 | 4.20 | 4.02 |
| 26 | 3.46 | 3.87 | 4.00 | 3.77 |
| S Levels | | | | |
| 0 | 3.18 | 3.63 | 3.08 | 3.29 |
| 7 | 3.49 | 4.08 | 3.90 | 3.82 |
| 9 | 3.93 | 3.94 | 4.20 | 4.02 |
| 12 | 3.51 | 3.63 | 4.00 | 3.71 |

**Cropping pattern : Chilli-T.Aman rice**
**Location : Lebukhali, Patuakhali**
**Year of establishment : 2001-02**

**Chilli**

A positive response of Chilli to different nutrients was observed. Fruit yield increased with the increase of nitrogen up to 110 kg/ha of N and then tended to decrease. Similarly, P, K and S also showed some response towards the yield and yield increased with the application of 60 kg/ha and 40 kg/ha of P and K, respectively.

**T.Aman**

Grain yield increased with the increase of nitrogen up to 60 kg/ha and after that level started to decrease. P and K also showed some response towards the yield. Grain yield increased up to the application of 20 kg/ha and 20 kg/ha of P and K, respectively.

From the response curve the optimum doses of the nutrients for the crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Chilli | 130 | 64 | 43 | - | 125 | 60 | 40 | - |
| T.Aman | 60 | 19 | 19 | - | 57 | 18 | 17 | - |

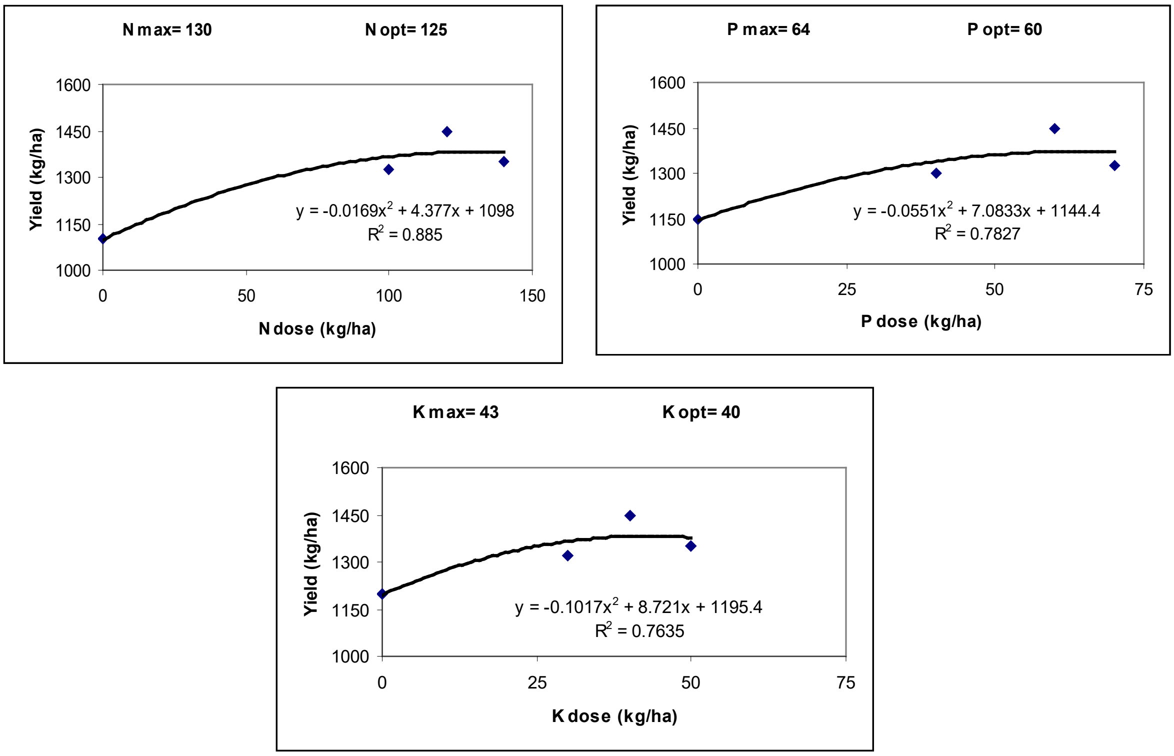


Figure 43. Response of Chilli to NPK grown in Chilli - T.Aman cropping pattern at FSRD site, Lebukhali, Patuakhali

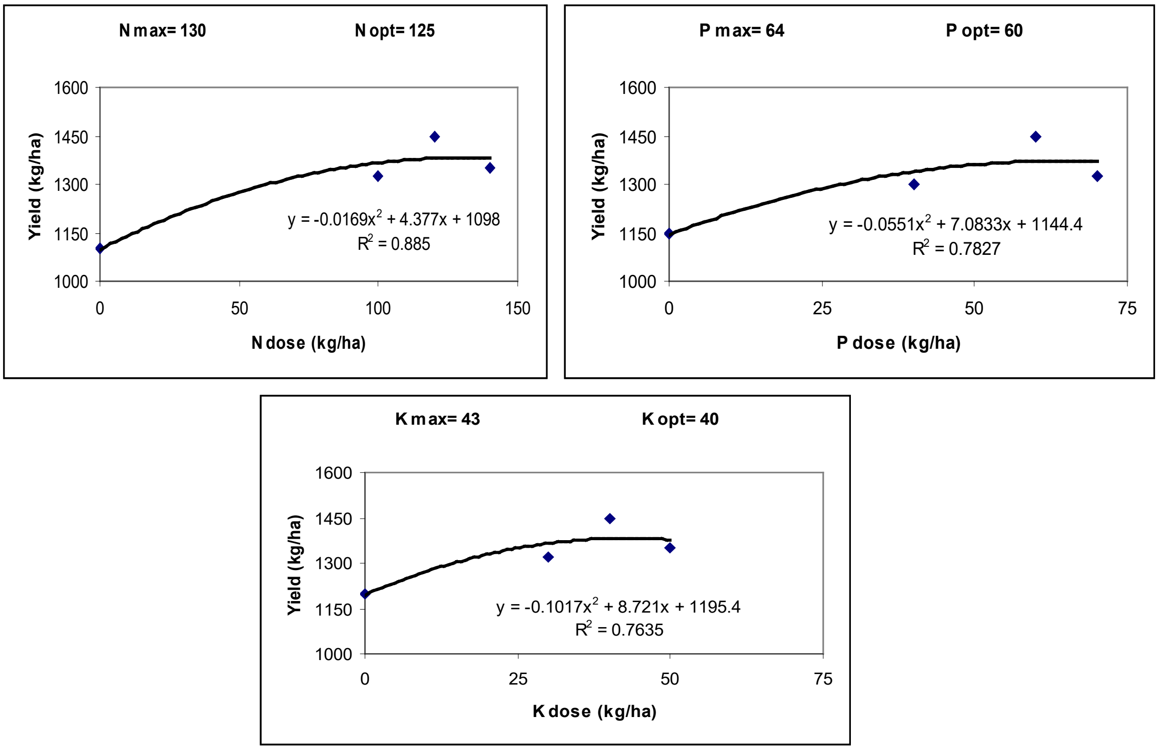


Figure 44. Response of T.Aman to NPK grown in Chilli - T.Aman cropping pattern at FSRD site, Lebukhali, Patuakhali

**Cropping pattern : Groundnut-T.Aman**
**Location : Atkapalia, Noakhali**
**Year of establishment : 2001-02**

### Groundnut

Response of nitrogen towards the nut yield of groundnut was not evident. As groundnut is a leguminous crop therefore, response to N was not found. However a very slowly increasing trend was found up to the highest level of added nitrogen. Similarly in case of P and K no appreciable yield increased was observed due to the addition of nutrients. Yield increased very slowly up to 24 and 20 kg/ha of P and K, respectively.

### T.Aman

Response of T.Aman rice to N was observed to some extent and grain yield was increased appreciably up to the application of 65 kg/ha of N. Response of T.Aman rice to P and K was not evident. However grain yield increased very slowly up to positive and yield increased up to 12 and 30 kg/ha of P and K, respectively.

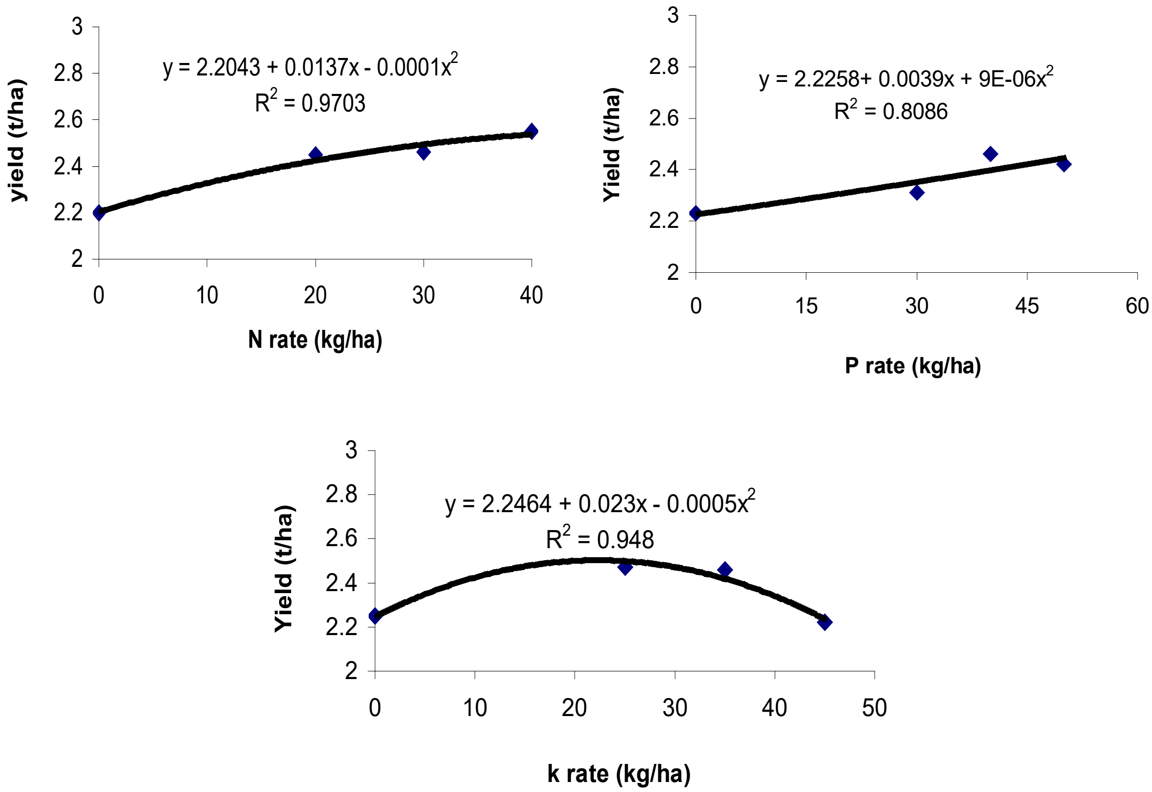


Figure 45. Response of Groundnut to NPK grown in Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali, 2001-02

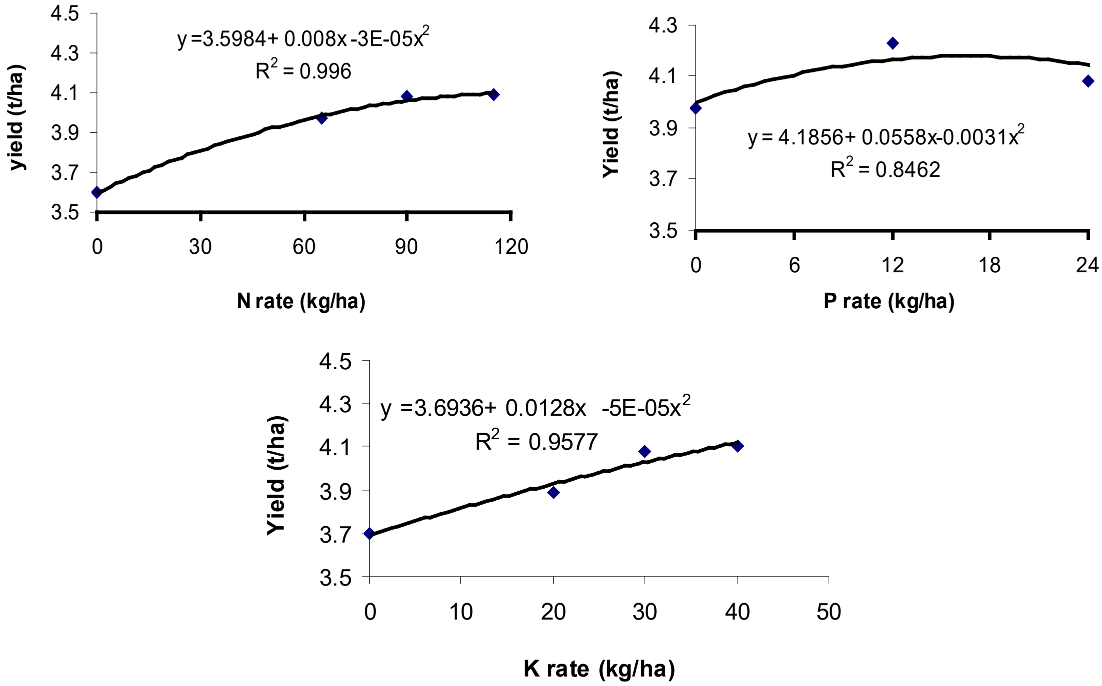


Figure 46. Response of T.Aman rice to NPK grown in Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali, 2001-02

Table 33. Effects of different levels of fertilizer nutrients on the yield crops in Groundnut-T.Aman cropping pattern at Atkapalia, Noakhali during 2001-02

| Nutrient levels (kg/ha) | | Grain yield (t/ha) | |
|---|---|---|---|
| Groundnut | T.Aman | Groundnut | T.Aman |
| N levels | | | |
| 0 | 0 | 2.20 | 3.60 |
| 20 | 65 | 2.45 | 3.97 |
| 30 | 90 | 2.46 | 4.08 |
| 40 | 115 | 2.55 | 4.09 |
| P levels | | | |
| 0 | 0 | 2.23 | 4.18 |
| 30 | 12 | 2.31 | 4.43 |
| 40 | 24 | 2.46 | 4.08 |
| 50 | 36 | 2.42 | 3.96 |
| K levels | | | |
| 0 | 0 | 2.25 | 3.70 |
| 25 | 20 | 2.47 | 3.89 |
| 35 | 30 | 2.46 | 4.08 |
| 45 | 40 | 2.22 | 4.10 |

**Location : Laxmipur, Noakhali**
**Year of establishment : 1999-2000 to 2001-02**

### Groundnut

Average of three years data showed that response of nitrogen towards the nut yield of groundnut was found to some extent. Nut yield increased up to the application of 30 kg/ha of N. Similarly in case of P and K response towards the yield was observed and nut yield increased up to 40 and 10 kg/ha of P and K, respectively.

### T.Aman

Response of T.Aman rice to N was observed to some extent and grain yield was increased appreciably up to the application of 78 kg/ha of N. Response of T.Aman rice to P and K was also found to some extent. Grain yield increased slowly up to 31 and 27 kg/ha of P and K, respectively.

From the response curve the optimum doses of the nutrients for the crops were calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Groundnut | 25 | - | 11 | - | 25 | - | 11 | - |
| T.Aman | 79 | 32 | 23 | - | - | 13 | 18 | - |

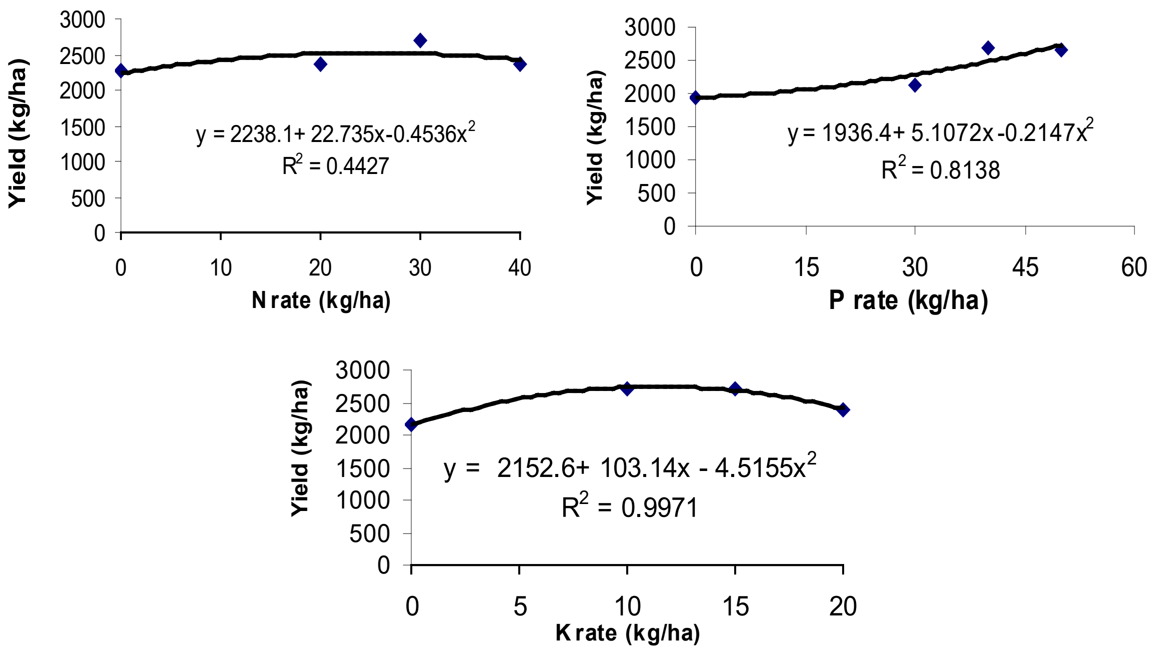


Figure 47. Response of Groundnut to NPK grown in Groundnut-T.Aman cropping pattern at MLT site, Laxmipur 1999-00 to 2001-02 (Average 3 years)

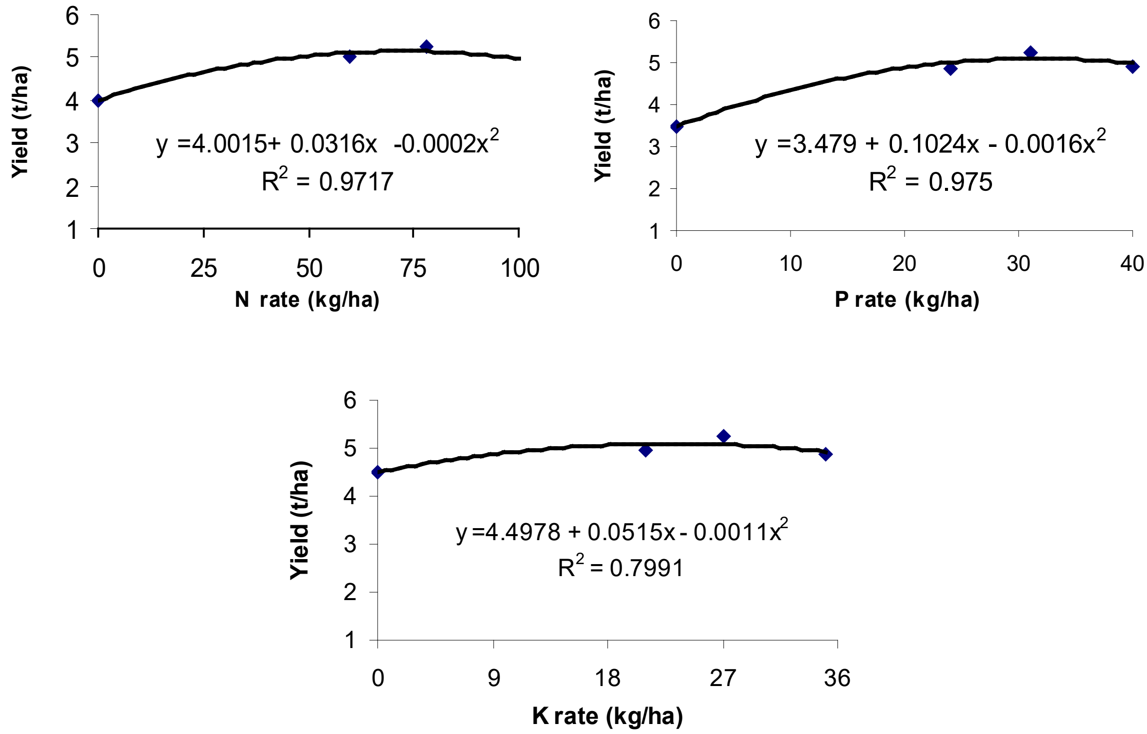


Figure 48. Response of T.Aman to NPK grown in Groundnut-T.Aman cropping pattern at MLT site, Laxmipur from 1999-00 to 2001-02(Average 3 years)

Table 34. Effects of different levels of fertilizer nutrients on the yield crops in Groundnut-T.Aman cropping pattern at Laxmipur, Noakhali during 1999-2000 to 2001-02 (Avg. of 3 years)

| Nutrient levels (kg/ha) | | Grain yield (t/ha) | |
|---|---|---|---|
| Groundnut | T.Aman | Groundnut | T.Aman |
| N levels | | | |
| 0 | 0 | 2.26 | 4.01 |
| 20 | 60 | 2.37 | 5.02 |
| 30 | 78 | 2.70 | 5.26 |
| 40 | 101 | 2.35 | 4.92 |
| P levels | | | |
| 0 | 0 | 1.95 | 3.49 |
| 30 | 24 | 2.14 | 4.88 |
| 40 | 31 | 2.70 | 5.26 |
| 50 | 40 | 2.64 | 4.92 |
| K levels | | | |
| 0 | 0 | 2.15 | 4.51 |
| 10 | 21 | 2.72 | 4.95 |
| 15 | 27 | 2.70 | 5.26 |
| 20 | 35 | 2.40 | 4.87 |

**Cropping pattern : Onion-B.Aman**
**Location : Baliakandi, Faridpur**
**Year of establishment : 2002-03**

**Onion**

Bulb yield of onion increased with the increase of N and the highest yield was recorded from 100 kg N/ha. After that level bulb yield tended to decrease. Almost similar trend was found in case of P, K & S and the yield increased up to 80 kg 50 kg and 30 kg/ha of P, K and S respectively. From the data a response curve was drawn and relationship is quadratic. From the response curve optimum dose of onion was find out.

From the response curve the optimum doses of the nutrients for Onion was calculated.

| Crop | Agronomically optimum dose | | | | Economically optimum dose | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| Onion | 97 | 75 | 86 | 35 | 96 | 53 | 76 | 34 |

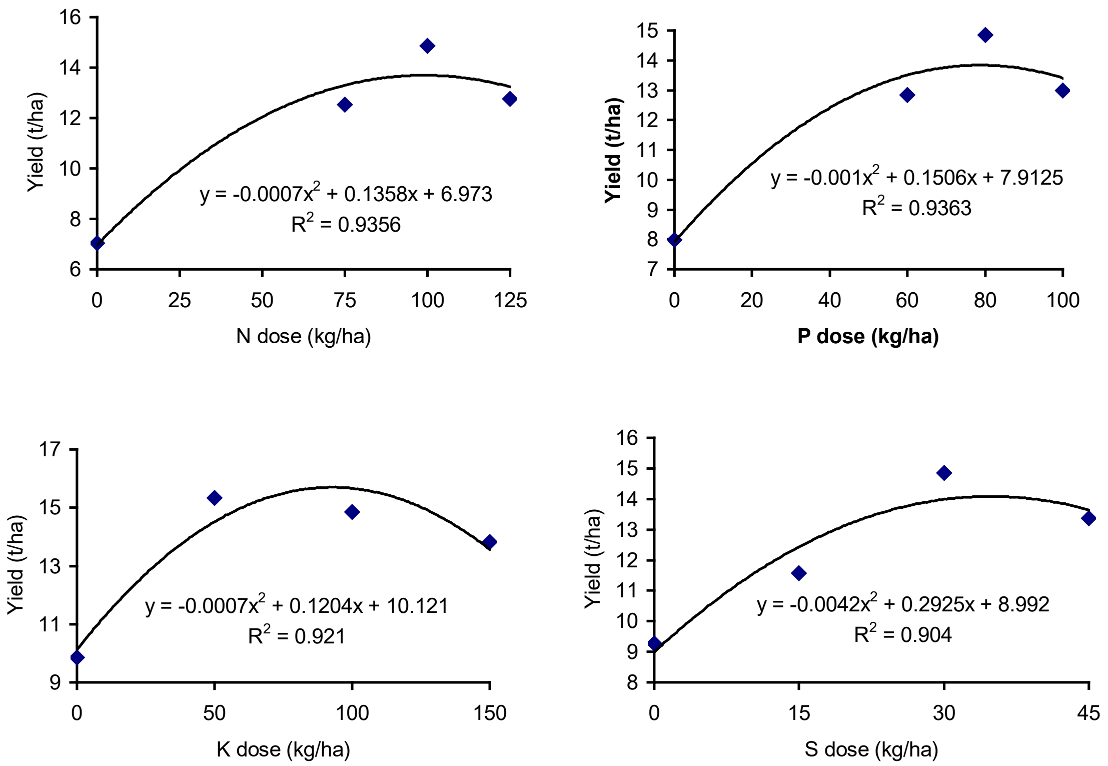


Figure 49. Response of onion to NPKS grown in Onion-B.Aman cropping pattern at Baliakandi, Rajbari during 2002-03

**Cropping pattern : T.Aus- T.Aman**
**Location : Jhalokati, Barisal**
**Year of establishment : 2002**

**T. Aus rice**

Grain yield of T.Aus rice increased sharply up to 60 kg/ha of N. However, the trend was increasing but slows up to 80 kg/ha and after that level tended to decrease. Similar trend was observed in case of P and yield increased up to 20 kg/ha of P.

**T.Aman rice**

Grain yield increased linearly with the increase of N and the highest yield was recorded from the highest level of N (102 kg/ha). However the rate of increment was very sharp up to 60 kg/ha of N. Similar trend was found in case of phosphorus also.

From the response curve optimum level of different nutrients was calculated.

| Crop | Agronomically optimum dose Kg/ha) | | | | Economically optimum dose (kg/ha) | | | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | N | P | K | S |
| T.Aus | 53 | 21 | - | - | 62 | 16 | - | - |
| T.Aman | 105 | 26 | - | - | 85 | 23 | - | - |

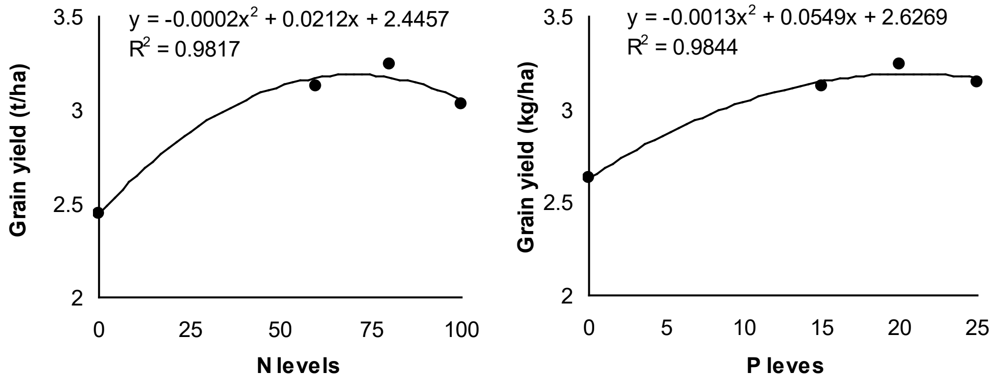


Figure 50. Response of T.Aus rice to NP grown in T.Aus-T.Aman cropping pattern at Jhalokati, Barisal, 2002

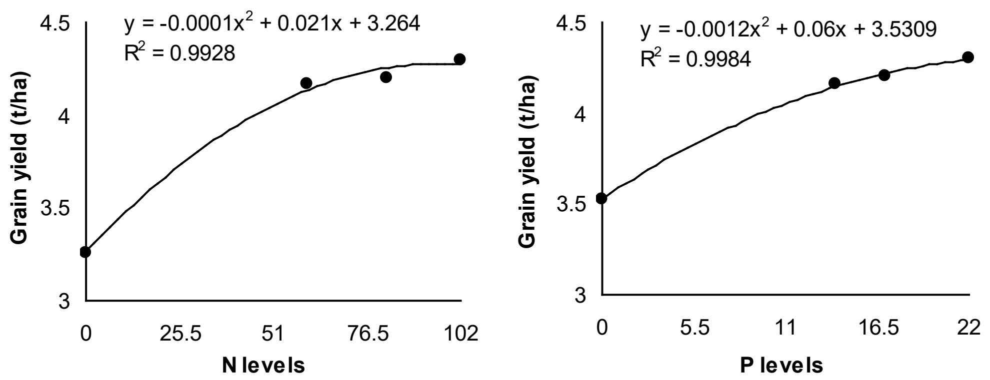


Figure 51. Response of T.Aman rice to NP grown in T.Aus-T.Aman cropping pattern at Jhalokati, Barisal, 2002

Table 35. Effects of different levels of fertilizer nutrients on the yield of crops in T.Aus-T.Aman cropping pattern at Jhalokati, Barisal, 2002

| Nutrient levels (kg/ha) | | Grain yield (t/ha) | |
|---|---|---|---|
| T.Aus | T.Aman | T.Aus | T.Aman |
| N levels | | | |
| 0 | 0 | 2.45 | 3.26 |
| 60 | 60 | 3.13 | 4.17 |
| 80 | 82 | 3.24 | 4.20 |
| 100 | 102 | 3.03 | 4.30 |
| P levels | | | |
| 0 | 0 | 2.63 | 3.53 |
| 15 | 14 | 3.12 | 4.16 |
| 20 | 17 | 3.24 | 4.20 |
| 25 | 22 | 3.15 | 4.30 |

**Cropping pattern : T.Aus- T.Aman**
**Location : Golapganj FSRD site & Moulvibazar MLT site, Sylhet**
**Year of establishment : 2000-2002**

**T. Aus rice**

Results of three years studies indicated that at two locations (Golapganj, Sylhet and Moulvibazar) grain yield of T.Aus rice increased up to 95 kg N/ha at Golapganj and up to 90 kg N/ha at Moulvibazar and there after the yield reduced. Almost similar trend was observed in case of P, K, and S and grain yield increased up to the application 22, 60 and 6 kg/ha and 15, 35 and 6 kg/ha of P,K, and S, at Golapganj FSRD site and Moulvibazar MLT site, respectively.

**T.Aman rice**

Grain yield increased with the increase of N levels up to 95 kg N/ha at Golapganj and 90 kg N/ha at Moulvibazar. Similarly the response was found in P, K and S up to 11, 60 and 3 kg/ha and 7, 35 and 3 kg/ha of P, K and S at Golapganj FSRD site and Moulvibazar MLT site, respectively.

From the response curve both agronomically and economically optimum level of different nutrients was calculated and it was observed that the agronomically optimum level is little higher than economically optimum level.

Table 36. Effect of different level of fertilizer nutrient on the yield of T.Aus-T.Aman-Fallow cropping pattern at FSRD Site, Golapganj, Sylhet during 2000, 2001 and 2002

| Treatment | | 2000 | | 2001 | | 2002 | | Mean | |
|---|---|---|---|---|---|---|---|---|---|
| T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman |
| Nitrogen rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 1.99 | 2.48 | 2.71 | 2.30 | 2.76 | 2.84 | 2.49 | 2.54 |
| 70 | 70 | 2.97 | 3.48 | 5.19 | 4.82 | 4.56 | 4.65 | 4.24 | 4.32 |
| 95 | 95 | 3.04 | 3.65 | 5.56 | 5.11 | 4.80 | 4.91 | 4.47 | 4.56 |
| 120 | 120 | 2.93 | 3.52 | 5.13 | 4.68 | 4.50 | 4.60 | 4.19 | 4.27 |
| Phosphorus rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.55 | 3.06 | 4.45 | 3.76 | 3.90 | 3.82 | 3.63 | 3.55 |
| 17 | 9 | 2.98 | 3.58 | 5.32 | 4.82 | 4.63 | 4.71 | 4.31 | 4.37 |
| 22 | 11 | 3.04 | 3.65 | 5.56 | 5.11 | 4.80 | 4.91 | 4.47 | 4.56 |
| 27 | 13 | 2.94 | 3.53 | 5.38 | 4.95 | 4.64 | 4.75 | 4.32 | 4.41 |
| Potassium rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.42 | 2.76 | 5.2 | 5.08 | 4.46 | 4.60 | 4.03 | 4.15 |
| 40 | 40 | 2.86 | 3.44 | 5.48 | 5.14 | 4.65 | 4.81 | 4.33 | 4.46 |
| 55 | 55 | 3.04 | 3.65 | 5.56 | 5.11 | 4.80 | 4.91 | 4.47 | 4.56 |
| 70 | 70 | 2.92 | 3.52 | 5.46 | 5.14 | 4.73 | 4.85 | 4.37 | 4.50 |
| Sulphur rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.71 | 3.38 | 4.11 | 4.30 | 3.81 | 4.30 | 3.54 | 3.99 |
| 4.8 | 2.4 | 2.98 | 3.6 | 5.38 | 4.90 | 4.67 | 4.76 | 4.34 | 4.42 |
| 6.4 | 3.2 | 3.04 | 3.65 | 5.56 | 5.11 | 4.80 | 4.91 | 4.47 | 4.56 |
| 8 | 4 | 2.95 | 3.59 | 5.47 | 5.01 | 4.70 | 4.78 | 4.37 | 4.46 |

Table 37. Effect of different level of fertilizer nutrient on the yield of T.Aus-T.Aman-Fallow cropping pattern at MLT Site, Moulvibazar during 2000, 2001and 2002

| Treatment | | 2000 | | 2001 | | 2002 | | Mean | |
|---|---|---|---|---|---|---|---|---|---|
| T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman | T.Aus | T.Aman |
| Nitrogen rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.24 | 2.51 | 2.60 | 3.19 | 2.96 | 2.97 | 2.60 | 2.89 |
| 70 | 70 | 3.11 | 3.51 | 5.19 | 5.53 | 4.74 | 4.90 | 4.35 | 4.65 |
| 90 | 90 | 3.28 | 3.80 | 5.42 | 5.68 | 4.97 | 5.14 | 4.56 | 4.87 |
| 110 | 110 | 3.16 | 3.76 | 5.24 | 5.4 | 4.80 | 4.97 | 4.40 | 4.71 |
| Phosphorus rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.78 | 3.25 | 4.22 | 4.13 | 4.00 | 4.00 | 3.67 | 3.79 |
| 14 | 7 | 3.10 | 3.62 | 5.20 | 5.38 | 4.86 | 4.98 | 4.39 | 4.66 |
| 17 | 8.5 | 3.28 | 3.8 | 5.42 | 5.68 | 4.97 | 5.14 | 4.56 | 4.87 |
| 20 | 10 | 3.18 | 3.72 | 5.26 | 5.4 | 4.82 | 4.94 | 4.42 | 4.69 |
| Potassium rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.62 | 3.12 | 5.08 | 5.36 | 4.68 | 4.87 | 4.13 | 4.45 |
| 30 | 30 | 3.12 | 3.67 | 5.32 | 5.61 | 4.82 | 5.03 | 4.42 | 4.77 |
| 40 | 40 | 3.28 | 3.8 | 5.42 | 5.68 | 4.97 | 5.14 | 4.56 | 4.87 |
| 50 | 50 | 3.15 | 3.75 | 5.35 | 5.67 | 4.86 | 5.11 | 4.45 | 4.84 |
| Sulphur rate (kg/ha) | | | | | | | | | |
| 0 | 0 | 2.95 | 3.58 | 3.93 | 4.74 | 3.93 | 4.42 | 3.60 | 4.25 |
| 3.6 | 1.8 | 3.22 | 3.75 | 5.24 | 5.45 | 4.83 | 4.99 | 4.43 | 4.73 |
| 4.8 | 2.4 | 3.28 | 3.8 | 5.42 | 5.68 | 4.97 | 5.14 | 4.56 | 4.87 |
| 6 | 3 | 3.18 | 3.72 | 5.34 | 5.58 | 4.87 | 5.04 | 4.46 | 4.78 |

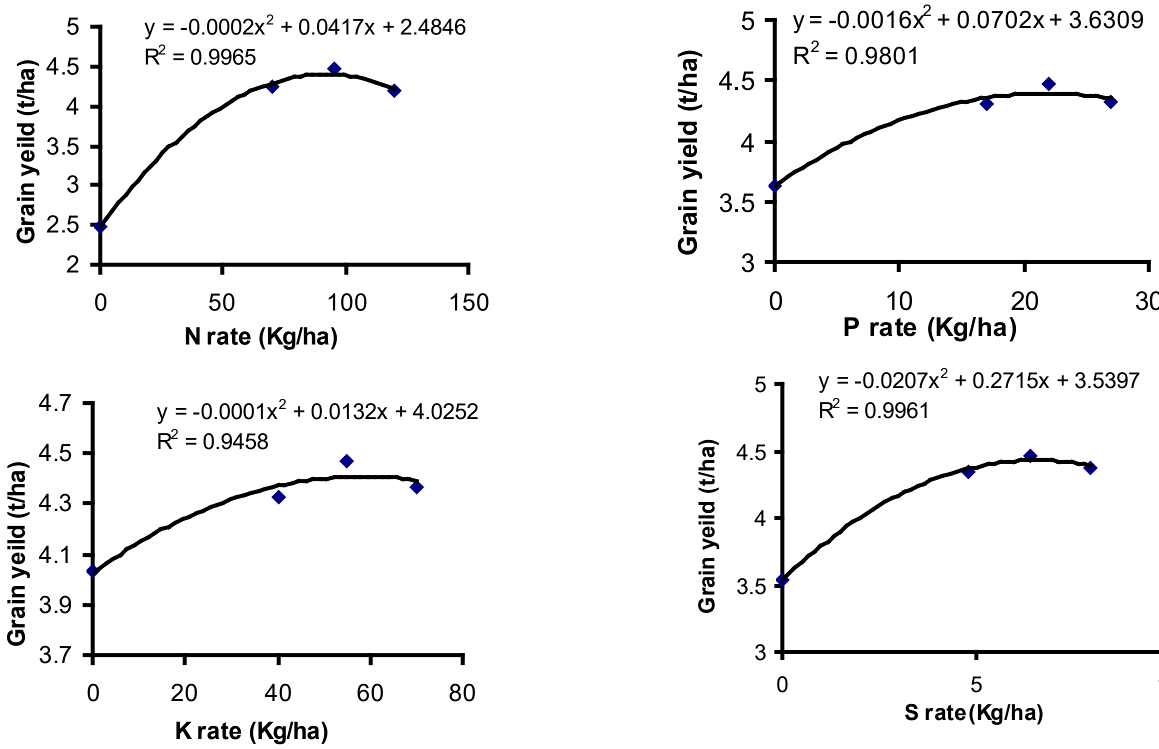


Figure 52. Response of T.Aus to NPKS grown in T.Aus- T.Aman-Fallow at FSRD site, Golapganj, Sylhet during 2000 to 2002

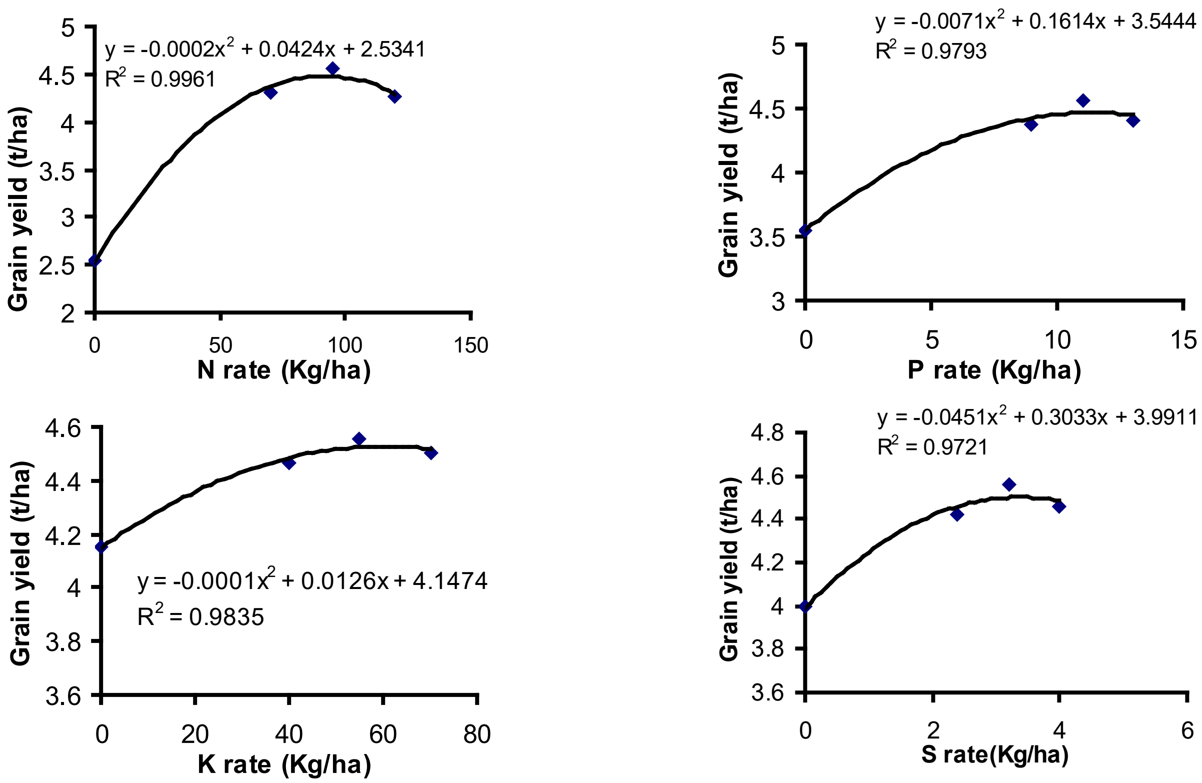


Figure 53. Response of T.Aman to NPKS grown in T.Aus- T.Aman-Fallow at FSRD site, Golapganj, Sylhet during 2000 to 2002

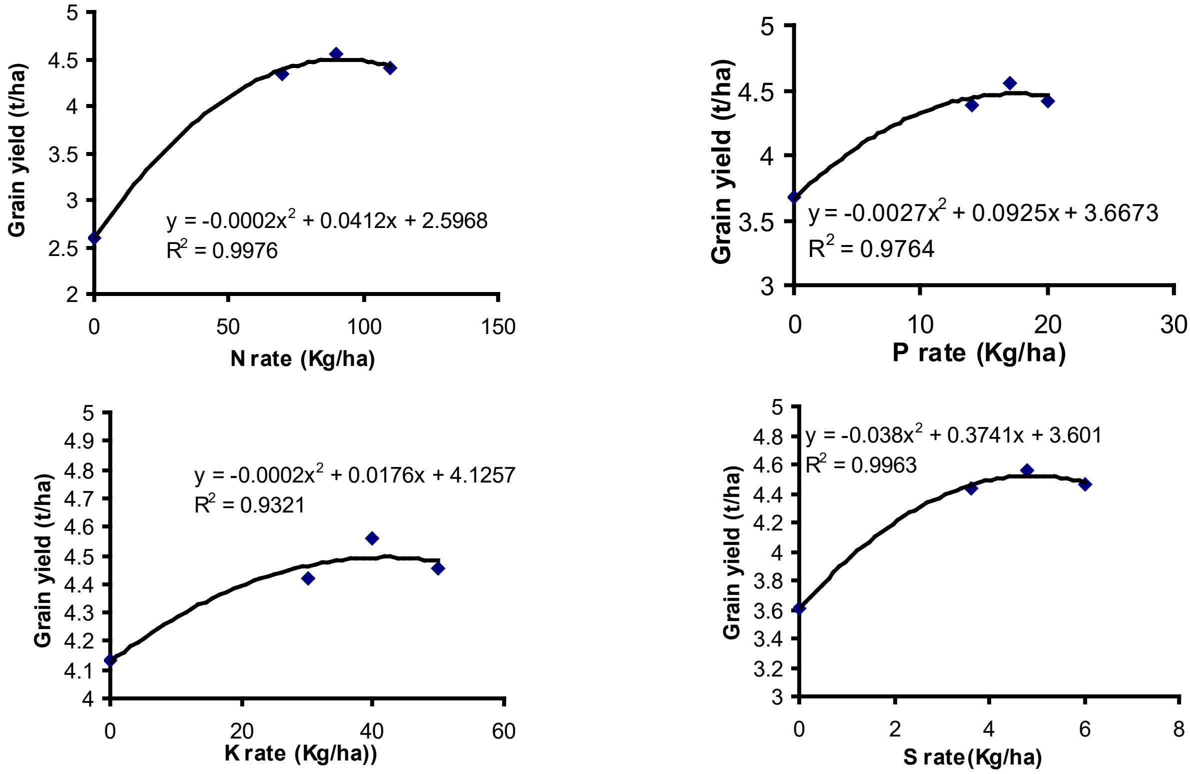


Figure 54. Response of T.Aus to NPKS grown in T.Aus- T.Aman-Fallow at MLT site, Moulvibazar during 2000 to 2002

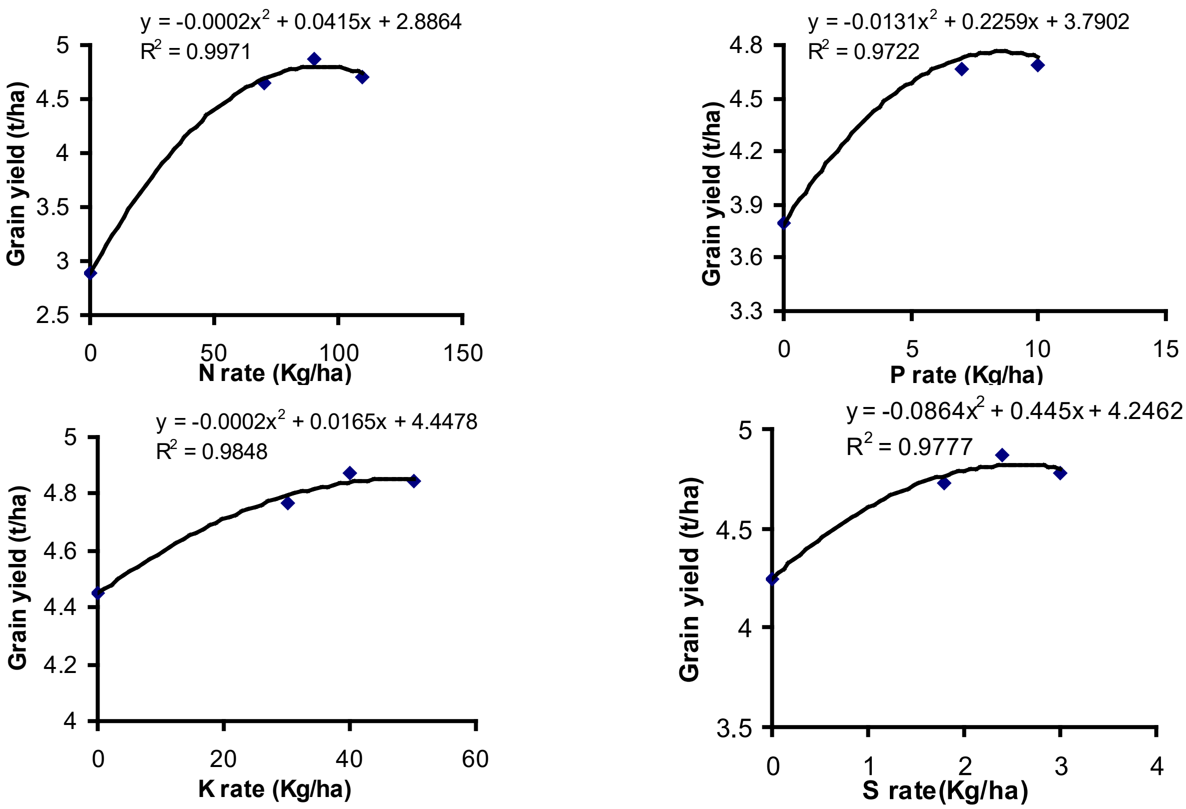


Figure 55. Response of T.Aman to NPKS grown in T.Aus- T.Aman-Fallow at MLT site, Moulvibazar during 2000 to 2002

**Appendices**

Appendix table 1. Initial soil status of the experimental site

| Location with AEZ | Land type | R/I | pH | O.C (%) | Total N (%) | K (m.eq./100g soil) | P | S | Zn | B |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ppm | | | |
| Muktagacha (9) | MHL | I | 5.42 | 2.12 | 0.18(L) | 0.059 (VL) | 8.6 (L) | 25.0 (Opt.) | - | - |
| Phulpur (9) | MHL | I | 5.17 | 1.38 | 0.08 (VL) | 0.18 (M) | 17.0 (M) | 11.5 (L) | 1.73 (O) | 0.22 (L) |
| Netrakona (9) | MHL | I | 5.00 | 1.61 | 0.08 (VL) | 0.30 (H) | 4.91 (VL) | 8.1 (VL) | 1.50 (O) | 0.27 (L) |
| Narikeli (9) | MHL | I | 5.6-6.15 | 1.0 | 0.05 (VL) | 0.08 (VL) | 8.15 (L) | 12.7 (L) | 0.67 (L) | 1.39 (VH) |
| Melandah (9) | MHL | I | 5.2-5.9 | 0.75-1.38 | 0.05-0.10 (L) | 0.06-0.76 (M) | 4.75-11.3 (L) | 5.08-10.9 (L) | 0.78-5.1 (M) | 0.05-0.29 (L) |
| Sherpur (9) | MHL | I | 5.0-6.2 | 0.55-1.31 | 0.025-0.101 (L) | 0.06-0.15 (VL) | 4.2-11.5 (L) | 6.6-15.5 (L) | 0.28-0.79 (VL) | 0.61-2.75 (VH) |
| Kendua (9) | MHL | I | 5.62 | 2.05 | 0.10 (L) | 0.13 (L) | 2.26 (VL) | 8.56 (VL) | - | - |
| Kishoreganj | MHL | I | 5.59 | 2.83 | 0.13 (L) | 0151 (L) | 3.80 (VL) | 23.6 (M) | - | - |
| Lebukhali (13) | MHL | R | 5.3 | 1.44 | 0.08 (VL) | 0.28 (Opt) | 4.4 (VL) | 33.46(Opt) | 0.34(VL) | - |
| Barind (26) | MHL | I | 8.48 | 1.53 | 0.08 (VL) | 0.16 (L) | 5.16 (L) | 19.5 (M) | 0.65 (L) | 0.29 (L) |
| Atkapalia (18) | MHL | R | 7.06 | 1.41 | 0.03 | 0.23 | 5.7 | 65.2 | 0.66 | - |
| Laxmipur (18) | MHL | R | 6.6 | 2.12 | 0.12 (L) | 0.19 (M) | 1.5 (VL) | 31.3 (VH) | 0.85 (L) | 0.47 (O) |
| Hathazari (23) | MHL | I | 5.57 | 1.52 | 0.08 (VL) | 0.04 (VL) | 2.50 (VL) | 10.6 (L) | - | - |
| Norail (11) | MHL | I | - | - | 0.11 (L) | 0.27 (M) | 1.88 (VL) | 36.0 (H) | 2.57 VH) | 0.82 (O) |
| Goyeshpur (11) | MHL | I | 7.7 | 2.97 | 0.15 (L) | 0.41 (M) | 5.26 (VL) | 19.5 (M) | 0.65 (O) | 0.23 (O) |
| Baliakandi (12) | MHL | I | 6.3 | - | 0.16 (L) | 0.44 (VH) | 1.84 (VL) | 18.5 (M) | - | - |
| Ishan Gopalpur (12) | MHL | I | 7.5 | - | 0.18 (M) | 0.42 (VH) | 9.03 (L) | 18.0 (L) | - | - |
| Golapganj (20) | MHL | R | 5.20 | 1.70 | 0.08 (VL) | 0.05 (VL) | 3.25 (VL) | 22.5 (M) | 0.73 (L) | 0.36 (M) |
| Moulvibazar (20) | MHL | R | 4.74 | 1.95 | 0.09 (VL) | 0.17 (M) | 9.56 (L) | 22.3 (M) | 3.30 (VH) | 0.58 (O) |
| Kolaroa (11) | MHL | I | 8.1 | 1.88 | 0.09 (L) | 0.22 (M) | 4.80 (VL) | 13.2 (L) | 0.51 (L) | - |
| Syedpur (3) | MHL | I | 5.4 | 2.41 | 0.14 (L) | 0.17 (M) | 9.1 (L) | 33.9 (O) | 1.3 (O) | 0.24 (L) |
| Polashbari (3) | MHL | I | 5.9 | 1.27 | 0.08 (VL) | 0.09 (L) | 10.1 (L) | 12.5 (L) | 1.10 (M) | 0.19 (L) |
| Nilphamari (3) | MHL | I | 5.1 | 1.55 | 0.09 (VL0 | 0.12 (L) | 16.5 (M) | 18.5 (M) | 1.24 (M) | 0.27 (L) |
| Jhalokati (13) | | | | | | | | | | |
| Norail | | | | | | | | | | |
| Bagherpara | | | | | | | | | | |

Appendix table 2. Crop management practices

| Site | Cropping pattern | Variety | Seed rate (kg/ha) | Planting time | Harvesting time |
|---|---|---|---|---|---|
| Muktagacha | Mustard | Tori-7 | 10 | $4^{th}$ week of Nov | $1^{st}$ week of Feb |
| | Boro | BR 28 | 40 | $2^{nd}$ week of Feb | $3^{rd}$ week of May |
| | T.Aman | BRRI Dhan 33 | 40 | $4^{th}$ week of July | $1^{st}$ week of Nov |
| Bagherpara | Mustard | Tori-7 | 08 | $3^{rd}$ week of Nov | $2^{nd}$ week of Feb |
| | Boro | BR 28 | 40 | $3^{rd}$ week of Feb | Last week of May |
| | T.Aman | BR 11 | 40 | Last week of July | $4^{th}$ week of Nov |
| Narikeli | Mustard | Tori-7 | 07 | $4^{th}$ week of Nov | Last week of Jan |
| | Boro | BRRI Dhan 28 | 50 | $1^{st}$ week of Feb | Last week of May |
| | T.Aman | BRRI Dhan 33 | 50 | $4^{th}$ week of July | $2^{nd}$ week of Nov |
| Melandah | Mustard | Tori-7 | 07 | $4^{th}$ week of Nov | Last week of Jan |
| | Boro | BRRI Dhan 28 | 50 | $1^{st}$ week of Feb | Last week of May |
| | T.Aman | BRRI Dhan 33 | 50 | $4^{th}$ week of July | $2^{nd}$ week of Nov |
| Sherpur | Wheat | Kanchan | 120 | $2^{nd}$ week of Dec. | Last week of March |
| | Jute | O-9897 | 8 | $3^{rd}$ week of April | Last week of July |
| | T.Aman | BRRI Dhan 33 | 50 | Last week of Aug | Last week of Oct. |
| Lebukhali | Mungbean | Kanti | 40 | $2^{nd}$ week of Feb | $4^{th}$ week of April |
| | T.Aus | BR 2 | 40 | $1^{st}$ week of May | $3^{rd}$ week of Aug. |
| | T.Aman | BR 23 | 40 | Last week of Aug | Last week of Dec |
| Jhalokati | T.Aus | | | | |
| | T.Aman | | | | |
| Kishoregonj | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | Last week of May |
| | T.Aman | BR 11 | 40 | Last week of July | $3^{rd}$ week of Nov |
| Kendua | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | Last week of May |
| | T.Aman | BRRI Dhan 32 | 40 | Last week of July | $3^{rd}$ week of Nov |
| Phulpur | Boro | BRRI Dhan 28 | 40 | Last week of Jan. | $1^{st}$ week of May |
| | T.Aman | BRRI Dhan 33 | 40 | Last week of July | Last week of Oct. |
| Netrakona | Boro | Pajam | 40 | $1^{st}$ week of Feb. | $2^{nd}$ week of May |
| | T.Aman | BRRI Dhan 33 | 40 | Last week of July | Last week of Oct. |
| Norail | Boro | BRRI Dhan 28 | 40 | $1^{st}$ week of Feb. | $3^{rd}$ week of May |
| | T.Aman | BR 11 | 40 | $3^{rd}$ week of July | Last week of Nov |
| Syedpur | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | $3^{rd}$ week of May |
| | T.Aman | BR 11 | 40 | $3^{rd}$ week of July | Last week of Nov |
| Polashbari | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | $3^{rd}$ week of May |
| | T.Aman | BR 11 | 40 | $3^{rd}$ week of July | Last week of Nov |
| Nilphamari | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | $3^{rd}$ week of May |
| | T.Aman | BR 11 | 40 | $3^{rd}$ week of July | Last week of Nov |
| Hathazari | Boro | BRRI Dhan 29 | 40 | $2^{nd}$ week of Jan. | $3^{rd}$ week of May |
| | T.Aman | BRRI Dhan 30 | 40 | Last week of July | $3^{rd}$ week of Nov |
| Barind | Wheat | Kanchan | 120 | $2^{nd}$ week of Nov | Last week of March |
| | T.Aman | BRRI Dhan 39 | 40 | $3^{rd}$ week of July | Last week of Oct. |
| Atkapalia | G.nut | Dhaka-1 | - | $1^{st}$ week of Jan. | $3^{rd}$ week of May |
| | T.Aman | BRRI Dhan 32 | 40 | $2^{nd}$ week of Aug. | $3^{rd}$ week of Nov. |
| Laxmipur | G.nut | Dhaka-1 | - | Last week of Dec. | $3^{rd}$ week of May |
| | T.Aman | BRRI Dhan 32 | 40 | Last week of July | $3^{rd}$ week of Nov. |
| Feni | Boro | BRRI Dhan 29 | 40 | $1^{st}$ week of Feb. | Last week of May |
| | T.Aman | BR 11 | 40 | Last week of July | $3^{rd}$ week of Nov |
| Goyeshpur | Wheat | Kanchan | 120 | $1^{st}$ week of Dec. | $4^{th}$ week of March |
| | T.Aman | BR 11 | 50 | Last week of July | $3^{rd}$ week of Nov |
| Kolaroa | Boro | BRRI Dhan 28 | 40 | Last week of Jan. | $1^{st}$ week of May |
| | T.Aman | BR-11 | 40 | Mid. Aug. | $3^{rd}$ week of Dec. |
| Golapganj | T.Aus | BR 26 | 40 | $1^{st}$ week of June | Mid. Aug. |
| | T.Aman | BRRI Dhan 32 | 40 | $1^{st}$ week of Sept. | Last week of Nov. |
| Moulvibazar | T.Aus | BR 26 | 40 | $1^{st}$ week of June | Mid. Aug. |
| | T.Aman | BRRI Dhan 32 | 40 | $1^{st}$ week of Sept. | Last week of Nov. |
| Baliakandi | Onion | Taherpuri | - | $2^{nd}$ week of January | Last week of March |
| Ishan Gopalpur | Boro | BRRI Dhan 29 | 40 | $3^{rd}$ week of Jan. | $2^{nd}$ week of May |
| | T.Aman | BRRI Dhan 32 | 40 | Last week of July | $3^{rd}$ week of Nov. |

# EFFECTS OF DIFFERENT LEVELS OF MAGNESIUM ON THE PERFORMANCE OF DIFFERENT CROPS AT RANGPUR


## Abstract

The experiment was conducted at FSRD site, Syedpur of OFRD, Rangpur during Rabi season of 2002-03. Five different levels of magnesium varied from crop to crop were tested against Potato, Tomato and Maize (hybrid) to find out the optimum and economic dose of Mg for the crops grown in magnesium deficient area of grater Rangpur. Results revealed that a positive response of crops to magnesium was evident. Yield of crops increased significantly with the application of Mg. The highest tuber yield of Potato (32.33 t $ha^{-1}$) was obtained from 10 kg $ha^{-1}$ of Mg that was also identical to 15 and 20 kg $ha^{-1}$of Mg. The highest fruit yield of Tomato (70.6 t $ha^{-1}$) was obtained from 16 kg $ha^{-1}$ of Mg that was also identical to 24 and 32 kg $ha^{-1}$ of Mg. Similarly, in Maize the highest grain yield (10.8 t/ha) was recorded from 20 kg $ha^{-1}$ of Mg that was also identical to 10, 30 and 40 kg $ha^{-1}$of Mg. Considering yield and economic return 10, 16 and 10 kg/ha of Mg was found optimum for growing Potato, Tomato and Maize (hybrid), respectively for grater Rangpur under AEZ 3.


## Introduction

Magnesium is one of the essential secondary nutrient elements for crop production. It is an important constituent of chlorophyll and therefore, essential for photosynthesis. It also promotes uptake and translocation of phosphorus. Generally, magnesium does not need to apply in the soil as its status in soil is optimum. But recently its deficiency was reported in medium highland soil of grater Rangpur under Tista Flood Plain (AEZ 3). Initial soil nutrient status also showed that Mg content of that area is low (0.14 meq/100 g of soil) and below the critical level (0.8meq/100 g of soil). The deficiency was observed in different crops particularly in rabi crops like Potato, Tomato and other vegetables crops and Maize. Last year at Lalmonirhat Maize was completely damaged due to sever Mg deficiency. Potato, Tomato and Maize is widely grown in Rangpur and area under those crops is expanding over the years. Magnesium recommendation for different crops is not yet available in our country even not mentioned in the national fertilizer recommendation guide (FRG'97). Therefore, it is very important to find out the optimum dose of Mg for different crops for successful crop production. Keeping this view in mind the experiment was undertaken to find out the optimum dose of Mg for Potato, Tomato and Maize (hybrid) for magnesium deficient area of AEZ # 3.

## Materials and Methods

The experiment was conducted at FSRD site, Syedpur during Rabi 2002-03 to find out the optimum dose of Mg for Potato, Tomato and Maize (hybrid). Five levels of Mg varied from crop to crop were tested against the crops. The trial was conducted in randomized complete block design with 6 dispersed replications. Initial soil samples were also collected from experimental plots and analyzed in SRDI laboratory, Rajshahi. The results of soil analysis are given in appendix table 1. The unit plot size was 5 m × 3 m. Details of the crop and fertilizer managements are given in appendix table 4. At maturity crops were harvested and necessary data were collected and analyzed statistically.

Different levels of magnesium were tested in different crops

| Crop | Mg levels (kg/ha) | | | | |
|---|---|---|---|---|---|
| Potato | 0 | 5 | 10 | 15 | 20 |
| Tomato | 0 | 8 | 16 | 24 | 32 |
| Maize (hybrid) | 0 | 10 | 20 | 30 | 40 |

## Results and Discussion

### Crop: Potato

The results presented in table 1 revealed that there was significant difference among the treatments in respect of tuber weight/hill and tuber yield. Significantly the highest tuber yield (32.33 t $ha^{-1}$) was obtained from the plot where 10 kg Mg $ha^{-1}$ was applied that was also identical to 15 and 20 kg Mg $ha^{-1}$, respectively. Significantly the lowest yield (25.33 t $ha^{-1}$) was obtained from the treatment where Mg was not applied (control).

Cost and return analysis showed that the highest gross return (Tk. 129320 $ha^{-1}$), gross margin (Tk. 85631 $ha^{-1}$) and BCR (2.96) were calculated from the treatment where 10 kg Mg $ha^{-1}$ was applied. On the other hand the highest MBCR (14.14) and marginal rate of return (1314%) were recorded from the treatment where 5 kg Mg $ha^{-1}$ was applied.

A response curve was drown with yield data obtained against different levels of Mg. The response was quadratic in nature and from the equation the Mg dose that maximized yield as well as profit was find out and it was 13kg Mg $ha^{-1}$ and 12 Kg $ha^{-1}$, respectively.

Table 1. Yield and yield contributing characters of potato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Levels of Mg (kg $ha^{-1}$) | Plant height (cm) | Plant $hill^{-1}$ (No.) | Tuber $hill^{-1}$ (No.) | Tuber weight $hill^{-1}$ (g) | Tuber yield (t $ha^{-1}$) |
|---|---|---|---|---|---|
| 0 | 78 | 3.59 | 10.4 | 420c | 25.33c |
| 5 | 81 | 3.62 | 10.8 | 479b | 29.55b |
| 10 | 79 | 3.82 | 10.9 | 530a | 32.33a |
| 15 | 79 | 3.72 | 10.8 | 505ab | 30.95ab |
| 20 | 80 | 3.77 | 10.5 | 499ab | 30.75ab |
| CV (%) | 3.2 | 5.8 | 5.6 | 5.9 | 6.2 |

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT

Table 2. Cost and return of potato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Mg Levels (kg $ha^{-1}$) | Gross return (Tk $ha^{-1}$) | Variable cost (Tk $ha^{-1}$) | Gross margin (Tk $ha^{-1}$) | BCR | MBCR | MRR (%) |
|---|---|---|---|---|---|---|
| 0 | 101320 | 41282 | 60038 | 2.45 | - | - |
| 5 | 118200 | 42476 | 75602 | 2.78 | 14.14 | 1183 |
| 10 | 129320 | 43689 | 85406 | 2.96 | 11.63 | 745 |
| 15 | 123800 | 45005 | 78570 | 2.75 | 6.04 | -477 |
| 20 | 123000 | 46321 | 76460 | 2.66 | 4.30 | -148 |

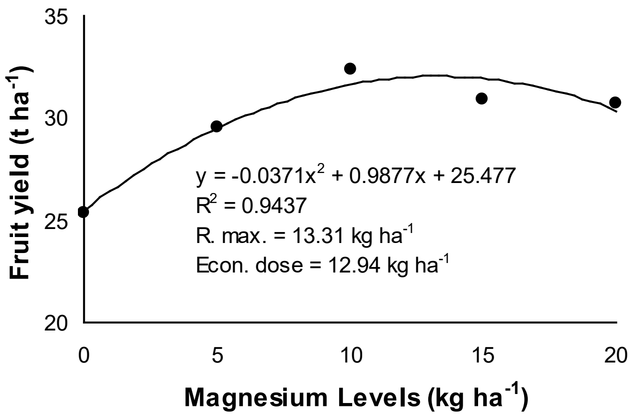


Figure 1. Response of Potato to added Magnesium at FSRD site, Syedpur, Rangpur during 2002-03

**Crop: Tomato**

The results revealed that there was significant difference among the treatments in respect of fruit weight per plant and fruit yield per hectare. Significantly the highest fruit yield (70.59 t $ha^{-1}$) was obtained from 16 kg Mg $ha^{-1}$ that was statistically identical to 24 and 32 kg Mg $ha^{-1}$, respectively. Significantly the lowest yield (56.09 t $ha^{-1}$) was obtained from the treatment where Mg was not applied (control). Almost similar trend was observed in fruit weight/plant. However, Plant height and number of fruits per plant did not differ significantly.

From cost and return analysis it was found that the highest gross return (Tk. 229418 $ha^{-1}$), gross margin (Tk. 184268 $ha^{-1}$), BCR (5.08), MBCR (12.22) and marginal rate of return (1426%) were calculated from 16 kg Mg $ha^{-1}$. From the response curve (Figure 2) the MG levels that maximized yield and profit was find out and it was 22 kg Mg $ha^{-1}$ and 21 Kg $ha^{-1}$, respectively.

Table 3. Yield and yield contributing characters of tomato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Levels of Mg (kg $ha^{-1}$) | Plant height (cm) | Fruit $Plant^{-1}$ (No.) | Fruit wt. $Plant^{-1}$ (g.) | Fruit yield (t $ha^{-1}$) |
|---|---|---|---|---|
| 0 | 74 | 27.5 | 1.69c | 56.09c |
| 8 | 74 | 27.7 | 1.88bc | 61.52b |
| 16 | 76 | 28.4 | 2.12a | 70.59a |
| 24 | 75 | 28.4 | 2.04a | 68.97a |
| 32 | 76 | 27.9 | 1.98ab | 66.46a |
| CV (%) | 3.5 | 8.4 | 9.3 | 6.3 |

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT

Table 4. Cost and return of tomato as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Levels of Mg (kg $ha^{-1}$) | Gross return (Tk $ha^{-1}$) | Variable cost (Tk $ha^{-1}$) | Gross margin (Tk $ha^{-1}$) | BCR | MBCR | MRR (%) |
|---|---|---|---|---|---|---|
| 0 | 182292 | 41295 | 140997 | 4.41 | - | - |
| 8 | 199940 | 43218 | 156722 | 4.63 | 9.18 | 818 |
| 16 | 229418 | 45150 | 184268 | 5.08 | 12.22 | 1426 |
| 24 | 224153 | 47161 | 176992 | 4.75 | 7.14 | -362 |
| 32 | 215995 | 49266 | 166729 | 4.38 | 4.23 | -738 |

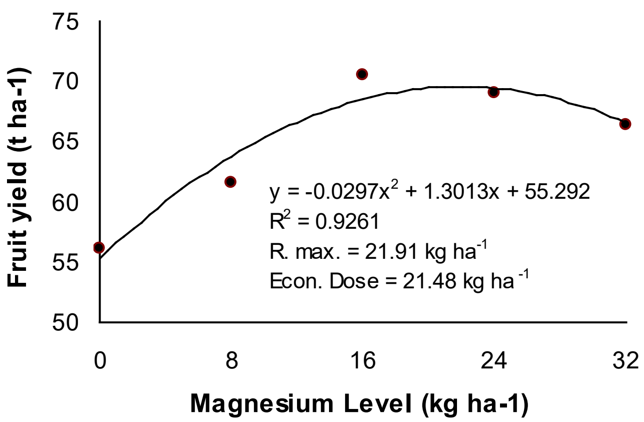


Figure 2. Response of Tomato to added Magnesium at FSRD site, Syedpur, Rangpur during 2002-03

**Crop: Maize (hybrid)**

The results showed that there was significant difference among the treatments in respect of number of grains per cob, 1000 seed weight, grain and straw yield. Significantly the highest grain yield (10.85 t $ha^{-1}$) was obtained from 20 kg $ha^{-1}$ of Mg that was statistically identical to the treatments where 10, 30 and 40 kg $ha^{-1}$ of Mg were applied, respectively. Significantly the lowest yield (8.85 t $ha^{-1}$) was obtained from the treatment where Mg was not applied (control). Similar trend was observed in number of grains per cob, 1000 seed weight and straw yield.
From the cost and return analysis it was found that the highest gross margin (Tk/ha) and marginal rate of return was obtained from the treatment where 10 kg Mg $ha^{-1}$ was applied. From the response curve it was also observed that 24 kg $ha^{-1}$ and 13 Kg $ha^{-1}$ of Mg was found optimum for maximum yield and profit, respectively.

Table 5. Yield and yield contributing characters of hybrid maize as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Levels of Mg (kg $ha^{-1}$) | Plant height (cm) | Days to maturity (Days) | Ear length (cm) | Cobs/ plant (no.) | Grains/ cob (no.) | 1000 grain wt (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| 0 | 197 | 142 | 21.3 | 1.50 | 519b | 350b | 8.85b | 9.92 |
| 10 | 197 | 145 | 22.7 | 1.65 | 566a | 360a | 10.77a | 11.73a |
| 20 | 198 | 145 | 22.2 | 1.63 | 570a | 363a | 10.85a | 11.95a |
| 30 | 197 | 144 | 22.8 | 1.60 | 568a | 363a | 10.69a | 11.64a |
| 40 | 196 | 144 | 22.6 | 1.60 | 567a | 362a | 10.45a | 11.48a |
| CV (%) | 4.1 | 3.4 | 5.5 | 8.1 | 5.9 | 1.8 | 7.2 | 7.8 |

Means followed by the same letter (s) in a column are not significantly different at 5% level by DMRT.

Table 6. Cost and return analysis of hybrid maize as affected by different levels of Mg at Syedpur FSRD site, OFRD, BARI, Rangpur during 2002-03

| Mg Levels (kg $ha^{-1}$) | Gross return (Tk. $ha^{-1}$) | Variable cost (Tk. $ha^{-1}$) | Gross margin (Tk. $ha^{-1}$) | MRR (%) |
|---|---|---|---|---|
| 0 | 75760 | 0 | 75760 | - |
| 10 | 92025 | 2632 | 89393 | 618 |
| 20 | 92775 | 5264 | 87511 | 0.28 |
| 30 | 91340 | 7896 | 83444 | - |
| 40 | 89340 | 10528 | 78812 | - |

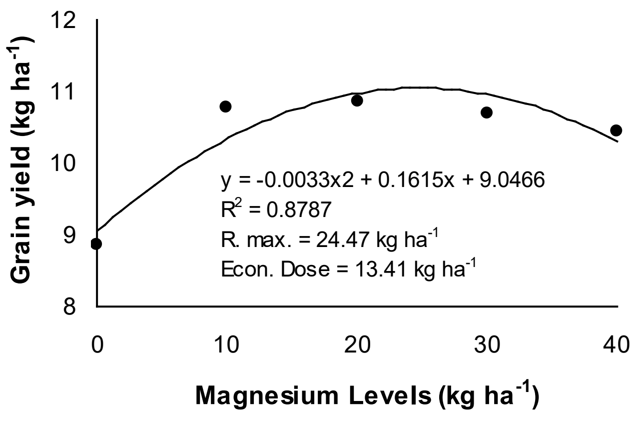


Figure 3. Response of hybrid maize to added Magnesium at FSRD site, Syedpur, Rangpur during 2002-03

Appendix table 1. Initial soil status of the experimental plots of Potato

| SL. | Soil Characteristic | Status | SL. | Soil Characteristic | Status |
|---|---|---|---|---|---|
| 1. | pH | 5.37 | 6. | P (Micro gram $g^{-1}$ soil) | 38.95 (VH) |
| 2. | OM (%) | 2.17 | 7. | S (Micro gram $g^{-1}$ soil) | 13.12 (L) |
| 3. | Mg (m eq/100g soil) | 0.82 (M) | 8. | Zn (Micro gram $g^{-1}$ soil) | 0.55 (L) |
| 4. | K (m eq/100g soil) | 0.42 (H) | 9. | B (Micro gram $g^{-1}$ soil) | 0.29 (L) |
| 5. | N (%) | 0.11 (L) | | | |

Appendix table 2. Initial soil status of the experimental plots of Tomato

| SL. | Soil Characteristic | Status | SL. | Soil Characteristic | Status |
|---|---|---|---|---|---|
| 1. | pH | 6.22 | 6. | P (Micro gram $g^{-1}$ soil) | 53.11 (VH) |
| 2. | OM (%) | 1.68 | 7. | S (Micro gram $g^{-1}$ soil) | 14.58 (L) |
| 3. | Mg (m eq/100g soil) | 0.46 (L) | 8. | Zn (Micro gram $g^{-1}$ soil) | 0.58 (L) |
| 4. | K (m eq/100g soil) | 0.49 (VH) | 9. | B (Micro gram $g^{-1}$ soil) | 0.25 (L) |
| 5. | N (%) | 0.11 (L) | | | |

Appendix table 3. Initial soil status of the experimental plots of Maize

| SL. | Soil Characteristic | Status | SL. | Soil Characteristic | Status |
|---|---|---|---|---|---|
| 1. | pH | 5.53 | 6. | P (Micro gram $g^{-1}$ soil) | 21.00 (M) |
| 2. | OM (%) | 1.78 | 7. | S (Micro gram $g^{-1}$ soil) | 9.00 (L) |
| 3. | Mg (m eq/100g soil) | 0.95 (M) | 8. | Zn (Micro gram $g^{-1}$ soil) | 1.10 (M) |
| 4. | K (m eq/100g soil) | 0.16 (L) | 9. | B (Micro gram $g^{-1}$ soil) | 0.39 (M) |
| 5. | N (%) | 0.08 (VL) | | | |

Appendix table 4. Crop management and fertilization

**Crop Management**

| | | Spacing (cm) | Planting time | Harvesting time | | |
|---|---|---|---|---|---|---|
| | | 60 cm x 25 cm | Last week of Nov. | 1st week of Feb. | | |
| | | 60 cm x 45 cm | Last week of Nov. | 1st week of April | | |
| | | 75 cm x 25 cm | 2nd week of Dec. | 2nd wk. of April | | |

**Fertilization**

| | Fertilizer rate (NPKSZn in kg/ha) | Application (Method & time) |
|---|---|---|
| | Mg: 0-5-10-15-20<br>NPKSZnB: 160-15-50-27-1-1.8 + CD @ 7.5 t/ha | In Potato, all PKS Mg Zn B and 1\2 of urea and cowdung was applied as basal and rest half of urea was side dressed at 30 DAP. |
| | Mg: 0-8-16-24-32<br>NPKSZnB: 160-15-50-27-1-1.8 + CD @ 5 t/ha | All P, S, Mg, Zn, B and cowdung was applied as basal. But N and K was applied in 2 equal splits at 15 and 35 DAP. |
| | Mg: 0-10-20-30-40<br>NPKSZnB: 250-45-150-40-3-1.5 + CD @ 5 t/ha | All PKS Mg Zn B and 1\2 of urea and cowdung was applied as basal and rest half of urea was side dressed in two splits at 40 and |

| | Fertilizer rate (NPKSZn in kg/ha) | Application (Method & time) |
|---|---|---|
| | | 70 DAP. |

## Subproject: Verification of Fertilizer Management Practices

### EFFECT OF UREA SUPER GRANULE (USG) AS A SOURCE OF NITROGENOUS FERTILIZER ON UPLAND VEGETABLES AND FRUITS


#### Abstract

The experiment was conducted at Narsinghdi, Tangail, Rangpur and Pabna during 2000-01 to 2002-03 to evaluate the effect of Urea Super Granule (USG) on upland vegetables and fruits crops. Different vegetables crops viz. Cabbage, Cauliflower, Tomato, Potato, Brinjal and fruits crops viz. Papaya were included in the trial. Recommended dose of USG, 10% and 20% less of recommended USG were tested along with recommended dose of prilled Urea and Farmers' practice. At Norshingdi recommended dose of prilled urea in ring placement was included as another treatment. Results revealed that yield of crops increased significantly due to application of USG over prilled urea. In most cases, 10-20% less of N as USG also produced identical yield with recommended dose of prilled urea. But at Norshingdi, recommended dose of USG and recommended dose of prilled urea in ring placement produced higher and identical yield. Placement of fertilizer is more important than source of fertilizer found at Norshingdi. About 10-20% nitrogen could be saved by using USG instead of prilled urea. Regarding economics, the higher returns were also obtained from USG treatments.


#### Introduction

Nitrogen is the most deficient nutrient element in Bangladesh soil. In general, farmers' of the country apply at least nitrogenous fertilizer to their crops for better yield. There are different types of nitrogenous fertilizers are now available in the market. Recently, Urea super Granule (USG) has become available in the market and used in wetland rice as well as upland crops. It is said that USG is more efficient than prilled urea in supplying N to crops as it is minimize loss by leaching and volatilization. USG is mostly used by farmers in boro rice and it is reported that 20-30% nitrogen could be saved by using USG compared to prilled urea. During the last couple of years farmers' in some parts of the country using USG in upland vegetables and fruit crops like brinjal, cabbage, cauliflower, tomato, papaya and banana. However, there is no recommendation of USG on upland crops are so far available and research findings in this regard are very scanty. Environment in wetland rice is quite different from upland condition and efficiency of USG on upland crops are yet to be ascertained. In this context the experiment was designed with the following objectives-

i) To find out the efficiency of USG on upland vegetables and fruits.
ii) To determine the optimum and economic dose of USG for upland crops.

#### Materials and Methods

The experiment was conducted at farmers' field of Shibpur, Narsinghdi, FSRD site Palima and MLT site Modhupur, Tangail, FSRD site Goyeshpur, Pabna and FSRD site Syedpur, Rangpur. The experiment was started with Cabbage and brinjal at Tangail during rabi season of 2000-01 and in 2002-03 extended in some new sites with new crops. Different vegetables viz. Cabbage, Cauliflower, Tomato, Potato and fruit crops viz. Papaya and Banana were included in the trial. Details about site characteristics and soils, crop management and fertilization are provided in appendix Table 1 and 2, respectively. The experiment was laid out in RCB design with 6 dispersed replications. Unit plot size was varied from 40 $m^2$ to 80 $m^2$. There were five treatments viz. ($T_1$) Recommended dose of N as prilled urea; ($T_2$) Recommended dose of N as USG; ($T_3$) 10% less N than recommended dose as USG; ($T_4$) 20% less N than recommended dose as USG and ($T_5$) Farmers' practice. But at Norshingdi recommended dose of prilled urea in ring placement was included as another treatment. Other nutrient elements PKSZn were applied in recommended rate. Yield attributes were collected from 10 randomly selected plants and yield was harvested from 10 $m^2$ area. All the data were analyzed statistically. Market price of the crop at harvest was recorded to calculate economics.

## Results and Discussion

**Location : Shibpur, Narsinghdi**
**Crop : Cabbage**

The highest head yield of Cabbage was obtained from recommended rate of USG (T3) which was identical to recommended rate of prilled urea applied in ring method (T2). Less of 10-20% of recommended USG produced similar yield with recommended prilled urea applied as broadcast method. It shows that recommended dose of N either as prilled urea with ring placement or as USG gave similar head yield.

Higher gross return, gross margin and benefit-cost ratio was obtained from treatment T3 that was very close to T2. From one year result it might be concluded that recommended dose of N either as USG or as prilled urea with ring placement could be used for growing cabbage at Narsinghdi for higher yield and profit.

Table 1. Agro-economic performance of cabbage as affected by USG application at Shibpur MLT site, Narsinghdi, 2002-03

| Treatment | Head yield (t/ha) | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | Benefit-cost ratio |
|---|---|---|---|---|---|
| $T_1$ | 78.94bc | 315760 | 60365 | 255395 | 5.23 |
| $T_2$ | 83.01ab | 332040 | 60715 | 271325 | 5.47 |
| $T_3$ | 84.88a | 339520 | 60715 | 278805 | 5.59 |
| $T_4$ | 77.24c | 308960 | 60535 | 248425 | 5.10 |
| $T_5$ | 75.36c | 301440 | 60355 | 241085 | 4.99 |
| T6 | 76.82c | 307280 | 60920 | 246360 | 5.07 |

Market price of cabbage = Tk. 4.00/kg

## Cauliflower

Higher curd yield was recorded from $T_3$ followed by $T_2$. Recommended dose of prilled urea applied as ring method and recommended dose of USG produced significantly identical yield. Similarly, recommended dose of prilled urea applied as broadcast method gave similar yield to 10% less of recommended USG. From the experiment it was clear that placement of fertilizer is more important than the source of fertilizer. When prilled urea was applied as ring method gave significantly higher yield over broadcast method. Application of 20% less USG than recommended USG markedly reduce the yield.

Cost and return analysis showed that higher gross return, gross margin and benefit cost ratio was obtained from $T_3$ followed by $T_2$. From the one year result it may be concluded that recommended dose of N either as USG or prilled urea with ring placement could be used for growing cauliflower at Narsinghdi for higher yield and return.

Table 2. Agro-economic performance of cauliflower as affected by USG application at Shibpur MLT site Narsinghdi, 2002-03

| Treatment | Curd yield (t/ha) | Gross return (Tk/ha) | Variable cost (Tk/ha) | Gross margin (Tk/ha) | Benefit-cost ratio |
|---|---|---|---|---|---|
| $T_1$ | 23.51b | 135183 | 53878 | 81305 | 2.51 |
| $T_2$ | 24.96a | 143520 | 54228 | 89292 | 2.64 |
| $T_3$ | 25.31a | 145533 | 54228 | 91305 | 2.68 |
| $T_4$ | 22.93bc | 131848 | 54100 | 77748 | 2.44 |
| $T_5$ | 21.09d | 121268 | 53970 | 67298 | 2.25 |
| $T_6$ | 22.33cd | 124378 | 54215 | 70163 | 2.29 |

Market price of cauliflower = Tk. 5.75/kg curd

**Location : Palima, Tangail**
**Crop : Cabbage**

Results revealed that (Table 3) in 2002-03 recommended USG gave the significantly highest head yield. Recommended rate of prilled urea gave identical yield to 20% less of recommended USG and farmers' practice gave the lowest yield. But during the year 2000-01 and 2001-02, higher and identical yield was obtained from recommended USG and 10% less of recommended USG. From the average of three years data showed that the highest head yield of cabbage was obtained from recommended USG followed by 10% less of recommended USG. Even 20% less of recommended USG gave higher yield over recommended prilled urea. The reason behind this is that in USG form, loss of nitrogen ($NO_3$-N and $NH_4$-N) through volatilization and de-nitrification is being reduced.

Regarding cost and return analysis it was observed that the highest gross margin as well as MBCR over farmers practice was obtained from recommended USG followed by 10% less of recommended USG.

Based on three years of experimentation it revealed that efficiency of N as USG is higher than prilled urea and 20% N could be saved by using USG instead of prilled urea.

Table 3. Effect of USG on yield and economics of Cabbage production at Palima, Tangail during 2000-01 to 2002-03

| Treatment | Yield (t/ha) | | | | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | MBCR |
|---|---|---|---|---|---|---|---|---|
| | 2000-01 | 2001-02 | 2002-03 | Average | | | | |
| Prilled urea (rec.) | 82.47c | 56.94b | 54.07c | 64.50 | 161250 | 73735 | 87515 | 1.89 |
| USG (rec.) | 91.73ab | 65.04a | 63.51a | 73.43 | 183775 | 73783 | 109992 | 5.61 |
| USG10%<Rec. | 94.81a | 60.14ab | 59.81b | 71.59 | 178975 | 73663 | 105312 | 4.94 |
| USG20%<Rec. | 88.77b | 55.09b | 56.20c | 66.69 | 166725 | 73543 | 93182 | 2.94 |
| Farmer's dose | 75.68d | 46.16c | 50.92d | 57.59 | 143975 | 67766 | 76209 | - |

Market price (Tk./kg): Cabbage = 2.50, Urea = 5.70, USG = 6.00, TSP = 14.00, MP = 9.00, Gypsum = 4.00, $ZnSO_4$ = 35.00

**Crop: Brinjal**

Fruit yield of Brinjal did not vary significantly among the treatments except with Farmers' practice in 2002-03. But during 2000-01 and 2001-02, the trend was quiet different and significantly higher yield was recorded from 10% less of recommended USG. Recommended prilled urea produced identical yield to 20% less of recommended USG. From the average of three years data it was found that the highest yield was obtained from 10% less of recommended USG. Even 20% less of recommended USG gave higher yield over recommended prilled urea.

Cost and return analysis showed that highest gross return and gross margin were recorded from 10% less than recommended USG application ($T_3$). MBCR over Farmers' practice was also highest in the same treatment.

From three years results, it was found that the USG (10%<rec.) performed better in terms of yield and economic return. At least 20% N could be reduced if USG was applied instead of prilled urea as source of nitrogen.

Table 4. Effect of USG on yield and economics of Brinjal production at Palima, Tangail during 2000-01 to 2002-03

| Treatment | Yield (t/ha) | | | | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | MBCR |
|---|---|---|---|---|---|---|---|---|
| | 2000-01 | 2001-02 | 2002-03 | Average | | | | |
| Prilled urea (Rec.) | 48.05c | 58.05c | 70.13a | 54.74 | 352440 | 48503 | 303937 | 6.27 |
| USG (Rec.) | 58.18b | 63.30b | 65.93ab | 62.47 | 374820 | 48523 | 326297 | 9.75 |
| USG10%<Rec. | 68.35a | 69.30a | 70.07a | 69.91 | 415440 | 48445 | 371015 | 16.95 |
| USG20%<Rec. | 51.94c | 57.80c | 65.32ab | 58.35 | 350100 | 48367 | 301733 | 6.05 |
| Farmer's dose | 39.64d | 51.61d | 61.80b | 51.02 | 306120 | 42131 | 263989 | - |

Market price (Tk./kg): Brinjal= 6.00, Urea = 5.70, USG = 6.00, TSP = 12.00, MP = 9.00, Gypsum = 4.00, $ZnSO_4$ = 35.00

**Crop: Cauliflower**

The highest head yield was recorded from 10% less of recommended USG but it was statistically identical to recommended USG and 20% less of recommended USG. But in previous year (2001-02) the significantly higher yield was obtained from recommended USG. Farmers' practice and recommended prilled urea gave similar and the lowest yield. From the average of two years data it was observed that the highest yield was obtained from recommended USG followed by 10% less of recommended USG. Effect of USG over prilled urea was very evident and even 20% less of recommended USG produced higher yield over recommended prilled urea. The lowest yield was recorded from farmers' dose.

From cost and return analysis it showed that the highest gross return, gross margin as well as MBCR were recorded from recommended USG followed by 10% less recommended USG. Application of USG as the source of N was found superior over prilled urea in terms of yield and return.

Table 5. Effect of USG on yield and economics of Cauliflower production at Palima, Tangail during 2001-02 to 2002-03

| Treatment | Yield (t/ha) | | | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | MBCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Average | | | | |
| Prilled urea (Rec.) | 48.10c | 44.25bc | 46.18 | 138540 | 55053 | 83487 | 2.52 |
| USG (Rec.) | 63.15a | 48.98ab | 56.07 | 168210 | 55077 | 113133 | 3.05 |
| USG10%<Rec. | 56.67b | 51.94a | 54.31 | 162930 | 55023 | 107907 | 2.96 |
| USG20%<Rec. | 54.17b | 47.50ab | 50.84 | 152520 | 54969 | 97551 | 2.77 |
| Farmer's dose | 45.88c | 41.11c | 43.50 | 130500 | 54217 | 76283 | 2.41 |

Market price (Tk./kg): Cauliflwer= 3.00, Urea = 5.70, USG = 6.00, TSP = 12.00, MP = 9.00, Gypsum = 4.00, $ZnSO_4$ = 35.00

**Crop : Tomato**

Higher fruit yield was recorded from recommended USG which was statistically identical to 10% less recommended USG. Recommended prilled urea produced identical yield to 20% less of recommended USG. However, the trend was slightly varied in previous year (2001-02) and significantly higher yield was obtained from recommended USG. Recommended prilled urea and 10% less of recommended USG produced statistically similar yield. From average data it was found that the highest yield was recorded from recommended USG but 10% less of recommended USG gave higher yield over recommended prilled urea.

The cost and return analysis showed that the highest gross return, gross margin as well as BCR was obtained from the USG (Rec.) dose. From Two years result it was found that recommended USG application was profitable in comparison to prilled urea.

Table 6. Effect of USG on yield and economics of Tomato at Palima, Tangail during 2001-02 to 2002-03

| Treatment | Yield(t/ha) | | | Gross return (Tk/ha) | TVC (Tk/ha) | Gross margin (Tk/ha) | BCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Average | | | | |
| Prilledurea (Rec.) | 92.78b | 78.00bc | 85.39 | 42695 | 93708 | 333242 | 4.55 |
| USG (Rec.) | 119.50a | 83.22a | 101.36 | 506800 | 97920 | 408880 | 5.17 |
| USG (10%<Rec.) | 96.09b | 80.15ab | 88.12 | 440600 | 96696 | 343904 | 4.55 |
| USG (20%<Rec.) | 75.75c | 74.52c | 75.14 | 375700 | 96472 | 279228 | 3.89 |
| Farmer's practice | 51.68d | 42.60d | 47.14 | 235700 | 91329 | 144391 | 2.58 |

Market price (Tk./kg): Tomato= 5.00, Urea = 5.70, USG = 6.00, TSP = 12.00, MP = 9.00, Gypsum = 4.00, $ZnSO_4$ = 35.00

**Location : Modhupur, Tangail**
**Crop : Potato**

Significantly higher tuber yield was recorded from recommended USG. Recommended prilled urea produced identical yield with other treatments except 20% less N as USG. But in 2001-02, recommended USG showed higher yield but at par to 10% less recommended N as USG. Average of two years data showed that the highest yield was obtained from recommended USG followed by 10% less of recommended USG. The efficiency of USG is much higher than prilled urea and even 10% less of recommended USG gave higher yield than recommended prilled urea.

The cost and return analysis showed that the highest gross return and gross margin was obtained from the USG (Rec.) dose followed by USG (10%<Rec). But BCR did not vary markedly among the treatments except farmers practice.

From two years result it was found that USG application was profitable in comparison to prilled urea. Even 10% less urea when applied as USG produced more tuber yield and economic return over recommended prilled urea dose.

Table 7. Effect of USG on yield and economics of Potato at Modhupur, Tangail during 2001-02 to 2002-03

| Treatment | Yield (t/ha) | | | Gross return (Tk/ha) | TVC (Tk/ha) | Gross margin (Tk/ha) | BCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Average | | | | |
| Rec. prilled urea | 24.46b | 20.94bc | 22.67 | 113350 | 34988 | 78362 | 3.24 |
| Rec. USG | 27.23a | 22.01a | 24.61 | 123090 | 53492 | 88102 | 3.52 |
| 10% <Rec.N as USG | 25.90ab | 21.30b | 23.60 | 118000 | 49577 | 83177 | 3.31 |
| 20% <Rec.N as USG | 22.79c | 20.53c | 21.62 | 108100 | 41766 | 73426 | 3.12 |
| Farmer's practice | 23.80bc | 21.32b | 22.56 | 112800 | 40124 | 72684 | 2.81 |

Market price (Tk./kg): Potato = 5.00, Urea = 5.60, USG = 6.00, TSP = 13.00, MP = 8.00, Gypsum = 4.00, $ZnSO_4$ = 35.00

**Location : Syedpur FSRD site, Rangpur**
**Crop : Potato**

No significant yield difference in Potato was observed among the treatments except with 20% less of recommended USG. However the highest yield was recorded from recommended USG. Recommended prilled urea produced similar yield with 10% less of recommended USG and Farmers' practice. Similar result was obtained in the previous year, 2001-02. From the average data it was found that the highest tuber yield in Potato was recorded from recommended USG and almost similar yield was obtained from recommended prilled urea, 10% less of recommended USG and Farmers' practice. About 10% yield was increased due to application of USG as source of nitrogen instead of prilled urea.

The cost and return analysis showed that the highest gross return, gross margin as well as benefit cost ratio was calculated from recommended USG. Recommended prilled urea and 10% less of recommended USG almost similar return.

From two years study it was clear that N use efficiency markedly increased in USG over prilled urea and even 10% less of recommended USG produced similar yield and return to recommended prilled urea.

Table 8. Effect of USG on yield and economics of Potato at FSRD site, Syedpur, Rangpur, during 2001-02 to 2002-03

| Treatment | Tuber yield (t/ha) | | | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Mean | | | | |
| $T_1$ | 27.11ab | 29.39ab | 28.25 | 99445 | 45938 | 53507 | 2.10 |
| $T_2$ | 30.29a | 31.85a | 31.07 | 109137 | 46400 | 62737 | 2.35 |
| $T_3$ | 27.02ab | 29.58ab | 28.30 | 99690 | 46171 | 53519 | 2.16 |
| $T_4$ | 26.37b | 27.22b | 2678 | 93995 | 45943 | 48052 | 2.05 |
| $T_5$ | 27.41ab | 29.83ab | 28.62 | 100775 | 45589 | 55186 | 2.21 |

Market price (Tk./kg): Urea = 6.00, USG = 7.00, TSP = 13.00, MP = 8.70, Gypsum = 3.00, ZnSO4 = 35.00, Borax: 40.00, Cowdung-=0.25, Potato seed= 10.00, Potato = 3.00

**Crop: Tomato**

Higher yield of tomato was recorded from recommended USG which was statistically identical to 10% less of recommended USG. Recommended rate of prilled urea produced similar yield with 20% less of recommended USG. The lowest yield was recorded from Farmers' practice. Almost similar result was observed during the year 2001-02. From the average data it was found that the highest fruit yield of Tomato was obtained from recommended USG. Even 20% less of recommended USG gave similar yield with recommended prilled urea.

From the cost and return analysis it was found that the highest gross return, gross margin and benefit cost ratio was obtained from recommended rate of USG followed by 10% less of recommended USG This results implied that use of urea super granule found to be economically viable compared to prilled urea.

Table 9. Effect of USG on yield and economics of Tomato at FSRD site, Syedpur, Rangpur during 2001-2002 to 2002-03

| Treatment | Fruit yield (t/ha) | | | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Mean | | | | |
| $T_1$ | 67.22b | 60.23cd | 63.73 | 165074 | 45328 | 119746 | 3.64 |
| $T_2$ | 79.13a | 73.60a | 76.37 | 198700 | 45660 | 153040 | 4.35 |
| $T_3$ | 73.69ab | 68.29ab | 70.29 | 184672 | 45428 | 139244 | 4.07 |
| $T_4$ | 68.13b | 62.45bc | 65.29 | 169582 | 45196 | 124386 | 3.75 |
| $T_5$ | 58.53c | 54.34d | 56.44 | 147153 | 38854 | 108299 | 3.79 |

Market price (Tk./kg): Urea = 7.00, USG = 7.00, TSP = 13.00, MP = 8.70, Gypsum = 3.00, ZnSO4 = 35.00, Borax: 40.00, Cowdung-=0.25, Tomato: 2.00, Seedling: Tk. 10.00/seedling

**Crop: Cabbage**

The highest head yield of Cabbage was obtained from recommended rate of USG which was statistically identical to recommended rate of prilled urea and 10% less of recommended USG. About 10% higher yield was recorded from USG over prilled urea. The N use efficiency is higher in USG and even 10% less of recommended USG produced higher yield than recommended prilled urea.

From the cost and return analysis it was found that the highest gross return, gross margin and benefit cost ratio was obtained from recommended rate of USG followed by 10% less of recommended USG. However, BCR among the treatments did not vary markedly and in all cases it is more than 2.

Table 10. Effect of USG on yield and economics of Cabbage at FSRD site, Syedpur, Rangpur during 2002-03

| Treatment | Head yield (t/ha) | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|
| $T_1$ | 66.23 ab | 149018 | 69079 | 79939 | 2.16 |
| $T_2$ | 72.28 a | 162630 | 70827 | 91803 | 2.29 |
| $T_3$ | 69.30 ab | 155925 | 70531 | 85394 | 2.21 |
| $T_4$ | 63.55 b | 142988 | 70236 | 72752 | 2.04 |
| $T_5$ | 63.67 b | 143258 | 70920 | 72338 | 2.02 |

**Location : Goyeshpur, FSRD site, Pabna**
**Crop : Papaya**

Fruit yield of Papaya did not vary significantly among the different treatments. During 2001-02 yield was only differed with Farmers' practice. No statistically significant difference was observed between prilled urea and USG. But from the average data it was found that the highest fruit yield was recorded from recommended USG. About 13% yield increased due to application of USG over prilled urea.

From cost and return analysis it was found that the highest gross return, gross margin and MBCR was calculated from recommended USG. Therefore, from the two years of experimentation it is evident that efficiency of USG is higher than prilled urea in respect of yield and return.

Table 11. Effect of USG on yield and economics of Papaya at FSRD site Goyeshpur, Pabna during 2001-02 to 2002-03

| Treatment | Yield (t/ha) | | | Gross return (Tk/ha) | TVC (Tk/ha) | Gross margin (Tk/ha) | MBCR |
|---|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Mean | | | | |
| $T_1$ | 102.06a | 87.61 | 94.83 | 284505 | 83065 | 201440 | 14.75 |
| $T_2$ | 116.17a | 97.28 | 106.72 | 320175 | 84281 | 235894 | 18.31 |
| $T_3$ | 101.51a | 85.12 | 93.31 | 279945 | 83409 | 196536 | 12.43 |
| $T_4$ | 86.43ab | 72.91 | 79.67 | 239010 | 82522 | 156488 | 3.19 |
| $T_5$ | 80.16b | 72.30 | 76.23 | 228690 | 79286 | 149404 | - |
| F test | | NS | | | | | |

Market price (Tk./kg): Urea = 6.00, USG = 6.50, TSP = 15.00, MP = 8.70, Gypsum = 3.00, ZnO = 40.00, Borax: 45.00, Labour = Tk. 50/day, Papaya = 3.00

**Crop: Cauliflower**

Curd yield of Cauliflower did not vary significantly among the treatments but slightly higher yield was obtained from USG followed by 10% less recommended USG. Yield obtained from recommended prilled urea was even less than 20% less of recommended USG.

From the cost and return analysis it was found that the highest gross return and gross margin was obtained from recommended USG followed by 10% less of recommended USG. BUT MBCR was the highest in 10% less of recommended USG.

Table 12. Effect of USG on yield and economics of Cabbage at FSRD site, Goyeshpur, Pabna during 2002-03

| Treatment | Curd yield (t/ha) | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk./ha) | MBCR |
|---|---|---|---|---|---|
| $T_1$ | 60.74 | 303700 | 43931 | 259769 | 68.09 |
| $T_2$ | 65.65 | 328250 | 44141 | 284109 | 90.35 |
| $T_3$ | 64.72 | 323600 | 43932 | 279668 | 150.03 |
| $T_4$ | 63.52 | 317600 | 43724 | 273876 | 289.95 |
| $T_5$ | 57.41 | 287050 | 43690 | 243360 | - |
| F test | NS | - | - | - | - |

Appendix table 1. Site characteristics

| Location | AEZ | Soil texture | $P^H$ | OM (%) | Total N (%) | K (meq/100 g soil) | Available nutrients (mg/g soil) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | P | S | Zn | B |
| Shibpur, Norshingdi | 9 | CL | 5.2 | 1.86 | 0.14 | 94.5 | 15.5 | 23.8 | 3.54 | - |
| Palima, Tangail | 8 | SCL | 5.8 | 1.72 | 0.07 | 0.10 | 5.20 | 13.0 | 7.54 | - |
| Modhupur, Tangail | 28 | SC | 5.02 | 1.56 | 0.10 | 0.05 | 25.9 | 4.13 | 1.01 | 0.04 |
| Syedpur, Rangpur | 3 | CL | - | - | - | - | - | - | - | - |
| Goyeshpur, Pabna | 11 | SCL | 8.4 | - | 0.75 | 0.26 | 5.0 | 4.45 | 0.48 | 0.46 |

Appendix table 2. Crop management and fertilization

**Crop Management**

| Site | Crop | Variety | Spacing (cm) | Planting time | Harvesting time | Irrig. (No.) | Pesticide use |
|---|---|---|---|---|---|---|---|
| Shibpur | Cabbage | Atlas-70 | 60 cm x 45 cm | Last week of Nov. | 28 Jan-2 Feb. | 3 | Dursban Dithane M-45 |
| | Cauliflower | Agrahayani | 60 cm x 60 cm | Last week of Nov. | 1st wk. of Feb. | 3 | Dursban Dithane M-45 |
| Palima | Brinjal | Singhnath | 60 cm x 60 cm | 1st wk. of Nov. | 18 Feb.-20 Mar. | 3 | - |
| | Cabbage | Atlas-70 | 60 cm x 60 cm | Last wk. of Oct. – 1st wk. of Nov. | Mid. Jan. | 2 | - |
| | Cauliflower | - | 60 cm x 60 cm | 12-22 Oct. | 20 Dec.-20 Jan. | 2 | - |
| | Tomato | BARI Tomato-8 | 60 cm x 40 cm | 3rd wk. of Nov. | Mid. Jan.- mid. Feb. | 2 | - |
| Modhupur | Potato | Diamont | 60 cm x 20 cm | 2nd wk. of Dec. | 2nd wk. of Mar. | 3 | Dimecrone Dithane M-45 |
| Syedpur | Potato | Cardinal | 60 cm x 25 cm | 8-9 Dec. | 1st wk. of Mar. | 3 | - |
| | Tomato | Ratan | 60 cm x 45 cm | 1st wk. of Dec. | 9 Mar.-6 April | 3 | - |
| Goyeshpur | Papaya | - | 2m x 2m | - | 1st wk. of Dec.-2nd wk. of April | - | Darsban, Dimecrone, Calthan |
| | liflower | v white | i0 cm x 45 cm | Last week of Oct. | eek of Feb. | 3 | jent |

**Fertilization**

| Site | Crop | Fertilizer rate (NPKSZn in kg/ha) | Application (Method & time) |
|---|---|---|---|
| Shibpur | Cabbage<br><br>Cauliflower | RF = 138-24-60-20 + CD @4t/ha<br>FP = 173-38-62 + CD @4t/ha<br>RF = 100-26-67-20 + CD @4t/ha<br>FP = 173-44-42 + CD @4t/ha | All PKS and CD were applied during final land preparation and prilled urea was topdressed in 3 equal splits at 20, 50, 65 DAT and 15, 30, 45 DAT for Cabbage and Cauliflower, respectively.<br>USG was applied at 15 and 20 DAT for Cabbage and Cauliflower, respectively, as ring method 4 inches apart from each plant and 3 inches deep in soil. |
| Palima | Cabbage<br><br>Cauliflower<br><br>Brinjal | RF = 195-56-162-13 + CD 3t/ha<br>FP = 105-25-90 + CD @5t/ha<br>RF = 97-50-80-10 + CD @5t/ha<br>FP = 103-22-37+ CD @5t/ha<br>RF = 78-36-66-3+ CD @3t/ha<br>FP = 60-35-60+ CD @5t/ha | All PKS and CD were applied during final land preparation and prilled urea was topdressed in 3 equal splits at 20, 50, 65 DAT and 15, 30, 45 DAT for Cabbage and Cauliflower, respectively.<br>USG was applied at 15 and 20 DAT for Cabbage and Cauliflower, respectively, as ring method 3-4 inches apart from each plant and 2-3 inches deep in soil.<br>In Brinjal, USG was applied at 21 DAT in 7.5-10 inches apart from plant and 5-7 inches depth of soil. But prilled urea was applied in three equal splits at 21, 35 and 55 DAT. |
| | Tomato | RF = 172-21-163-37<br>FP = 128-36-78 | In Tomato USG was applied at 15 DAT in 7.5-10 inches apart from plant and 5-7.5 inches depth of soil. But prilled urea was applied in two equal splits at 13 and 35 DAT. |
| Modhupur | Potato | RF = 136-6-139-21-1<br>FP = 115-75-190-15-2.5 | In Potato, all PKSZn and 1\2 prilled urea applied as basal and rest half urea was side dressed at 30 DAP. USG was applied between tuber in ground level at the time of planting. |
| Syedpur | Potato<br><br>Tomato | RF = 140-28-70-10-15-1.5-1 + CD @5t/ha<br>FP = 103-22-37+ CD @5t/ha<br>RF = 150-40-140-30-4-1+ CD @5t/ha<br>FP = 101-34-62-9+ CD @2t/ha | In Potato, all PKS Mg Zn B and 1\2 prilled urea applied as basal and rest half urea was side dressed at 30 DAP. USG was applied between tuber in ground level at the time of planting.<br>In Tomato USG was applied at 15 DAT in 7.5-10 inches apart from plant and 5-7.5 inches depth of soil. But prilled urea was applied in two equal splits at 13 and 35 DAT. |
| | bbage | RF = 172-7-24-38-0.5-10+ CD @6t/ha<br>FP = 164-40-124-32-2-1 + CD @7.5t/ha | All PKS and CD were applied during final land preparation and prilled urea was top dressed in 3 equal splits at 20, 50, 65 DAT. USG was applied as ring method at 15 DAT. |
| Goyeshpur | Papaya | RF = 633-277-690-113-8-18 + CD @3.5t/ha + MOC@ 750 kg/ha<br>FP = 60 kg N/ha | All PSZNB and CD and 50% K was applied in pit 7 days before planting. Rest 25% and 2/3rd N was applied at 30 DAP. Remaining N and K was applied at 60 DAP. |
| | Cauliflower | =158- 54-45-33 kg/ha of NPKS<br>= 60 kg N/ha | Entire amount of TSP, MP, Gypsum and Borax were applied as basal. Prilled urea was applied in two installments at 15 and 35 DAP. USG was applied at 20 DAP in 3-4 inches apart from plant and 2-3 inches depth of soil. |

# EFFECT OF VARIETY AND NITROGEN FERTILIZER MANAGEMENT ON THE YIELD OF TOMATO AT SHIBPUR MLT SITE, NARSINGDI


## Abstract

An experiment was carried out at farmers' field of Shibpur MLT site, Narsingdi to determine efficiency of USG as a source of N and also its optimally economic dose of USG for Tomato. The experiment was laid out in Spilt plot design with 4 dispersed replication. Two tomato varieties BARI Tomato-2 (Ratan) and BARI Tomato-8 (Shila) were assigned to main plots and sub-plots received six treatments with N source viz. $S_1$) Recommended dose of N as prilled urea (broadcast), $S_2$) Recom. dose of N as prilled urea (ring placement), $S_3$) 10%<Reco. dose of prilled urea (ring placement), $S_4$) Recom. dose of N as USG; $S_5$) 10%<Recom. dose of N as USG and; $S_6$) Farmers' dose. The variety Shila gave significantly highest yield than Ratan. Significantly higher yield was obtained from the variety Shila with recommended dose of N as USG which was statistically similar to recommended dose of N applied as prilled urea in ring placement with same variety. Economic analysis showed that variety Shila with recommended dose of N as USG provided higher benefit-cost ratio.


## Introduction

Narsingdi district is well known for growing vegetables and fruits. It has diversified land type belonging to AEZ-9. About 10 thousand hectares of land of the district is under vegetable cultivation and rabi vegetables are grown in 6000 hectares of land (source: DAE, Narsingdi). Farmers grow vegetables in medium high land having cropping pattern Jute-Fallow-Vegetable. But farmers do not grow same vegetables in the same land every year. Farmers apply fertilizers to individual crop but type and amount of nutrient varies for particular crop. This may affect crop yield and soil health as well. Particularly farmers use higher dose of N which is harmful to environment. Tomato is one of the major winter crops grown here. A production programme was conducted on BARI released tomato varieties BARI Tomato-2 and BARI Tomato-3 during 1996-97. Both the varieties gave remarkably higher yield than the local variety and farmers accepted those varieties. But in the recent years farmers are not getting potential yield of tomato. So, there was a need to check whether variety or nutrient management is responsible for lower yield of tomato. The present study was thus designed to achieve the following objectives.

i. To select appropriate variety of tomato
ii. To determine efficient management of N for profitable production of Tomato

## Materials and Methods

The experiment was conducted at farmers' field of Shibpur Multi Location Testing (MLT) site, Narsingdi during rabi 2002-2003. The land was medium high with sandy loam soil belonging to AEZ 9. The initial soil fertility status (Table-1) was determined by collecting soil samples from each replication and analyzed in the SSD laboratory, BARI. The experiment was laid out in Spilt Plot with 4 dispersed replications. Size of unit plot was 4m x 3m. Two tomato varieties BARI Tomato-2 (Ratan) and BARI Tomato-8 (Shila) were assigned to main plots whereas sub-plots received six N management treatments viz. $S_1$) Recommended dose of N as prilled urea (broadcast), $S_2$) Recom. dose of N as prilled urea (ring placement), $S_3$) 10% <Recom. dose of N as prilled urea (ring placement), $S_4$) Recom. dose of N as USG; $S_5$) 10%<Recom. N as USG and; $S_6$) Farmers' management. The recommended fertilizer dose for Tomato as calculated based on soil test value (IPNS perspective) was 175-20-22-12-30-2-5000 kg N-P-K-Mg-S-B-CD/ha and farmers' dose 81-101-90-5000 kg N-P-K-CD/ha. All of Cow dung (CD), P, K, Mg, S and B were applied at the time of final land preparation. Prilled urea (broadcast) was applied as top dress in two equal splits at 15 and 35 DAT. In case of prilled urea (ring method), placements were done twice at 15 and 35 DAT in rings made 17.5 - 25 cm apart from each plant and 7.5 cm deep in the soil. USG was applied once at 15 DAT at 17.5- 25.cm apart from each plant and dibbled 12.5 cm deep in the soil. Two irrigation was applied following top dress of N. Pesticides like Dithane M-45, Rovral and Ridomil were applied as per recommendation.

Earthing up was done about 1 month after transplanting. About 30-day old seedlings were planted at 60 cm x 40 cm. Seedlings were transplanted during 26 October to 3 November, 2002. The crop was harvested during 3-17 February, 2003. Yield attributes were collected from 5 randomly selected plants and analyzed statistically. Market price of the crop was recorded at each harvest to calculate economics.

## Results and Discussions

Analysis of soil samples showed that soil pH is close to neutral and organic matter content of soil is moderate. Soil was very low in N but P and K content was medium. Mg, S and B was at or below critical level.

### Effect of variety

Plant height, fruit clusters/plant and fruit yield was significantly affected by variety. The variety **Shila** showed significantly highest plant height, fruit clusters/plant than variety **Ratan**. Significantly highest yield was obtained from Shila due to higher number of fruit clusters/plant, individual fruit weight and fruit yield /plant.

### Effect of nitrogen management

Plant height and all yield attributes were significantly affected by nitrogen management treatments except plant population/plot. Treatments $S_1$, $S_2$ and $S_4$ were statistically identical in respect of plant height and clusters/plant and higher than other treatments. The lowest plant height and clusters/plant was obtained from $S_6$ (Farmers' management). Fruits/clusters was statistically similar in treatment $S_1$ and $S_2$ which were higher than other treatments. Significantly highest individual fruit wt. and fruit yield/plant were recorded from ($S_4$) which were statistically identical to $S_2$. Highest fruit yield was obtained from treatment $S_4$ (recommended dose of N as USG) which was statistically similar to treatment $S_2$ (recommended dose of N as prilled urea with ring placement) due to higher fruit wt. and fruit yield/plant.

### Interaction between variety and fertilizer

Each of the yields attributes and fruit yield along with plant height was significantly influenced by variety and nitrogen management interaction. Plant population/plot was statistically similar. Significantly higher number of fruit clusters/plant were obtained from $S_2V_1$, $S_2V_2$ and $S_2V_4$. The variety Shila showed higher no. of cluster/plant in all nitrogen management treatment than variety Ratan. But fruit/cluster was higher in case of variety Ratan in $S_1$ & $S_2$. Higher individual fruit wt. and fruit yield/plant was showed in variety Shila with recommended dose of N as USG ($S_4$) that was at par to $S_2$ in same variety. The variety Shila gave significantly highest fruit yield with recommended dose of N as USG and statistically identical yield of the variety was also obtained with recommended dose of N as prilled urea with ring placement ($S_2$). Recommended dose of N as USG produced 8% higher yield than recommended dose of N as prilled urea (broadcast) which is currently used. Whereas farmer's dose showed 22.5% less yield than recommended dose of N as USG. Reduction of N (10%) as USG or prilled urea (ring placement) reduced yield significantly than recommended dose of N.

### Economic performance

The highest gross return and gross margin was obtained from variety Shila with recommended dose of fertilizer of N as USG ($V_2S_4$) which was close to $V_2S_2$. Variety Ratan showed lower gross return and gross margin than Shila in all treatments. However, the variety Shila with recommended dose of N as USG showed higher benefit-cost ratio closely followed by recommended dose of N as prilled urea (ring placement) with same variety.

## Conclusion

One-year result showed that the tomato variety Shila performed better than Ratan. Again, Shila produced significantly higher yield with recommended dose of N as USG or recommended dose of N as prilled urea (ring placement) and benefit-cost was also higher with the same variety and treatments. For more confirmation the experiment should be repeated next year.

### Farmer's reaction

Farmers preferred variety Shila as it gave higher yield than Ratan. The other reasons they mentioned that plants of variety Shila was more strong and stout and more resistant to diseases. But they germination percentage of Shila was poor compared to Ratan.

Table 1. Effect of variety on the yield and yield attributes of Tomato at Shibpur MLT site, Narsingdi during rabi 2002-03

| Treatment | Plant Population /12 m$^2$ | Plant height (cm) | Fruit cluster/ plant (No.) | Fruits/ clusters (No.) | Individual fruit wt. (g) | Fruit yield/ plant (kg) | Fruit yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Ratan ($V_1$) | 42.6 | 61.28 | 7.10 | 2.98 | 70.5 | 1.77 | 62.39 |
| Shila ($V_2$) | 43.4 | 83.98 | 9.39 | 2.61 | 78.5 | 1.96 | 70.36 |
| LSD $_{(.05)}$ | NS | 11.62 | 1.59 | NS | NS | NS | 6.20 |

Table 2. Effect of N management on the yield and yield attributes of Tomato at Shibpur MLT site, Narsingdi during rabi 2002-03

| Treatment | Plant Population /12 m$^2$ | Plant height (cm) | Fruit cluster/ plant (No.) | Fruits/ clusters (No.) | Individual fruit wt. (g) | Fruit yield/ plant (kg) | Fruit yield (t/ha) |
|---|---|---|---|---|---|---|---|
| $S_1$ | 42.9 | 74.53 | 8.65 | 2.98 | 77.0 | 1.92 | 68.65 |
| $S_2$ | 43.1 | 74.38 | 8.63 | 2.95 | 80.6 | 2.01 | 71.17 |
| $S_3$ | 43.0 | 71.90 | 8.25 | 2.81 | 72.5 | 1.81 | 64.73 |
| $S_4$ | 42.5 | 74.65 | 8.38 | 2.76 | 82.9 | 2.07 | 73.31 |
| $S_5$ | 43.1 | 71.01 | 7.93 | 2.68 | 69.1 | 1.73 | 62.35 |
| $S_6$ | 43.3 | 69.33 | 7.65 | 2.58 | 65.0 | 1.63 | 57.90 |
| LSD $_{(.05)}$ | NS | 0.37 | 0.27 | 0.38 | 2.41 | 0.06 | 3.31 |

Table 3. Interaction between variety and N management on the yield and yield attributes of Tomato at Shibpur MLT site, Narsingdi during rabi 2002-03

| Treatment | Plant Population /12 m$^2$ | Plant height (cm) | Fruit cluster/ plant (No.) | Fruits/ clusters (No.) | Individual fruit wt. (g) | Fruit yield/ plant (kg) | Fruit yield (t/ha) |
|---|---|---|---|---|---|---|---|
| $V_1S_1$ | 42.8 | 62.30 | 7.50 | 3.15 | 73.5 | 1.82 | 65.23 |
| $V_1S_2$ | 43.0 | 61.60 | 7.45 | 3.20 | 70.8 | 1.91 | 66.73 |
| $V_1S_3$ | 42.5 | 60.85 | 7.05 | 3.00 | 67.5 | 1.68 | 59.06 |
| $V_1S_4$ | 41.5 | 63.15 | 7.25 | 2.90 | 78.8 | 1.97 | 68.05 |
| $V_1S_5$ | 42.8 | 60.38 | 6.80 | 2.85 | 65.3 | 1.65 | 59.99 |
| $V_1S_6$ | 43.0 | 59.40 | 6.55 | 2.75 | 61.5 | 1.57 | 54.93 |
| $V_2S_1$ | 43.0 | 86.75 | 9.80 | 2.80 | 80.5 | 2.02 | 72.76 |
| $V_2S_2$ | 43.3 | 87.15 | 9.80 | 2.70 | 84.5 | 2.11 | 75.60 |
| $V_2S_3$ | 43.5 | 87.95 | 9.45 | 2.63 | 77.5 | 1.94 | 70.30 |
| $V_2S_4$ | 43.5 | 86.15 | 9.50 | 2.63 | 87.0 | 2.18 | 78.56 |
| $V_2S_5$ | 43.5 | 81.65 | 9.05 | 2.50 | 73.0 | 1.81 | 64.70 |
| $V_2S_6$ | 43.5 | 79.25 | 8.75 | 2.4 | 68.5 | 1.69 | 60.87 |
| LSD $_{(.05)}$ | NS | 1.24 | 0.33 | 0.12 | 2.95 | 0.07 | 4.06 |
| CV (%) | 3.70 | 1.00 | 3.90 | 2.90 | 2.70 | 2.60 | 4.20 |

Table 4. Cost and return analysis of tomato as affected by variety and N management at Shibpur MLT site, Narsingdi during rabi 2002-03

| Treatment | Gross return (Tk/ha) | Total cost of production (Tk/ha) | Gross Margin (Tk/ha) | Benefit-Cost Ratio |
|---|---|---|---|---|
| $V_1S_1$ | 684915 | 77362 | 607553 | 8.85 |
| $V_1S_2$ | 700665 | 77712 | 622953 | 9.02 |
| $V_1S_3$ | 620130 | 77414 | 542716 | 8.01 |
| $V_1S_4$ | 714525 | 77712 | 636813 | 9.19 |
| $V_1S_5$ | 629895 | 77414 | 552481 | 8.14 |
| $V_1S_6$ | 576765 | 77845 | 498920 | 7.45 |
| $V_2S_1$ | 756735 | 77362 | 679373 | 9.78 |
| $V_2S_2$ | 793800 | 77712 | 716088 | 10.21 |
| $V_2S_3$ | 738150 | 77414 | 660736 | 9.54 |
| $V_2S_4$ | 740880 | 77712 | 747168 | 10.61 |
| $V_2S_5$ | 679350 | 77414 | 601936 | 8.78 |
| $V_2S_6$ | 639135 | 77845 | 561290 | 8.21 |

Market price of Tomato = Tk 10.5/kg

Appendix table 1: Analytical data of initial soil sample (from SSD, BARI, Joydebpur, Gazipur)

| Sample | pH | OM % | Ca | Mg | K | Total N % | P | S | Cu | Fe | Mn | Zn | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | meq/100 ml | | | | µg/ml | | | | | | |
| 1. | 5.5 | 1.12 | 3.9 | .80 | .28 | .059 | 10 | 15 | 3.0 | 248 | 7.8 | 3.4 | 0.20 |
| 2. | 5.8 | 1.26 | 3.5 | .68 | .30 | .067 | 18 | 11 | 5.2 | 287 | 18.6 | 6.0 | 0.22 |
| **Mean** | **5.7** | **1.19** | **3.7** | **0.74** | **.29** | **.063** | **19** | **13** | **4.1** | **268** | **13.2** | **4.7** | **0.21** |
| Critical level | | | 2.0 | 0.8 | 0.2 | | 14 | 14 | 1.0 | 10.0 | 5.0 | 2.0 | 0.20 |

# EFFECT OF DIFFERENT LEVELS AND METHODS OF NITROGEN APPLICATION ON THE GROWTH AND YIELD OF CAULIFLOWER


## Abstract

An experiment was conducted at Farming System Research and Development (FSRD) site, Goyeshpur, Pabna during the Rabi season of 2000-01 to 2002-03 to find out the optimum nitrogen fertilizer dose and the best method of fertilizer application for cauliflower production. Four different nitrogen fertilizer doses along with no fertilizer treatment and three fertilizer management practices were employed for the experiment. Average of three years data revealed that higher levels of nitrogen with 50% basal and two equal split at 30 and 45 DAP gave significantly higher yield of cauliflower.


## Introduction

Cauliflower (Brassica *oleracea* var. *botrytis*) is an important winter vegetable crop in Bangladesh and its annual production of 79 metric tons (BBS, 1997-98). It is a high value cash crop for early and late growers in winter season. In Pabna district it is very popular winter crop to the farmers and they grow it as a commercial crop. A field survey result also revealed that variety 'White Contessa' performed well in FSRD site, Goyeshpur, Pabna. But the farmers of the area did not follow the recommended fertilizer dose particularly for nitrogenous fertilizer and have very little knowledge about the method of application. As a result, the yield is not at satisfactory level. The efficiency of nitrogen fertilizer could be increased more than 30% of existing by its proper nitrogen fertilizer management. Keeping these views in mind, the present study was undertaken with the following objectives.

i. To find out optimum nitrogen dose and the best method of application;
ii. To find out a economic nitrogen dose for cauliflower.

## Materials and Methods

The experiment was conducted at FSRD site, Goyeshpur, Pabna during the winter season of 2000-01 to 2002-03 in High Ganges River Flood Plain (AEZ 11). Before starting the experiment a composite soil sample was collected and analyzed (Appendix 1). The experiment was laid out in two-factor RCB design with three replications. Four level of nitrogen fertilizer were used e.g. Control (No), Medium Yield Goal (MYG=68kgN/ha), High Yield Goal (HYG=98kg N/ha) and Farmers Practice (FP=120kgN/ha). Three management practices were $M_1$= Half of N was be applied as basal and rest two equal splits at 30 and 45 DAP, $M_2$ = In three equal installment at 15, 30 and 45 DAP (Farmers Practice), $M_3$= In two equal installments at 15 and 35 DAP (Rec. practice) as top dress. Except nitrogen other fertilizer were used at the rate of 34-80-20-7.5 kg P- K-S-B/ha ( Recom. dose) and at the rate of 38-112.5-19-1..5 Kg P-K-S-B/ha (Farmers' Practice). The unit plot size was 3.6m x 3m. Cauliflower (var. White Contessa) 35 days seedling were transplanted in 2nd week of November with 60 cm x45 cm spacing. Nitrogen fertilizer was used as per treatment and others fertilizers were used during final land preparation. Pesticide 'Fifanon' was used three times against leaf borer and crops were irrigated two times at 15 and 45 DAP. 50% curd initiation were started at 35-40 DAP. Other intercultural operations were done as and when required. Crops were harvested in 1st week of January. Necessary data were collected and analyzed statistically.

## Results and Discussion

Results showed that curd yield of Cauliflower varied significantly among the treatments. The highest curd yield (58.93 t/ha) was obtained in 2002-03 from HYG+$M_1$ treatment which was statistically similar to HYG +M2, HYG+M3 and MYG + M2. During 2001-02 yield was comparatively low due to irrigation problem. But the trend was almost same. During the year 2000-01, the highest yield was recorded from HYG+$M_1$ which was also identical to HYG + M3. From the average of three years data it was found that the highest yield was recorded from HYG + M1 treatment. Higher levels of nitrogen (HYG) with 50% basal and two equal split at 30 and 45 DAP produced the highest yield. The 2nd highest yield was recorded from HYG + M3, i.e. nitrogen dose for HYG with two equal installments at 15 and 35 DAP (recommended practice). This result indicated that application of 50% nitrogen as basal plays a significant role for higher production of cauliflower.

From cost and return analysis (average) it was found that the highest gross margin and MBCR over control were obtained from high yield goal with $M_1$ management (HYG+$M_1$) where 50% basal and two equal splits of nitrogenous fertilizer were applied at 30 and 45 DAP. Almost similar trend was observed over the years.

## Conclusion

From the results of three consecutive years it was concluded that higher rate of nitrogenous fertilizer with 50% basal and two equal split at 30 and 45 DAP had significant positive effect on yield of cauliflower.

**Recommendation:**

Nitrogenous fertilizer for high yield goal (98 kg /ha of N) with 50% basal and two equal split at 30 and 45 DAP could be recommended for growing of Cauliflower in High Ganges River Flood plain soils of Pabna.

Table 1. Effect of different fertilizer doses and management on yield of cauliflower at FSRD site, Goyeshpur during 2000-01 to 2002-03

| Treatments | Curd yield (t/ha) | | | |
|---|---|---|---|---|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| No | 25.99d | 9.27f | 23.35c | 19.54 |
| MYG + $M_1$ | 41.98c | 24.34bcd | 45.36d | 37.23 |
| MYG + $M_2$ | 44.70bc | 22.45cd | 50.62ab | 39.26 |
| MYG + $M_3$ | 43.15c | 17.47c | 46.35b | 35.66 |
| HYG + $M_1$ | 59.39a | 29.23a | 58.93a | 49.18 |
| HYG + $M_2$ | 44.70bc | 23.82bcd | 50.83ab | 39.78 |
| HYG + $M_3$ | 55.64ab | 21.15de | 50.36ab | 42.38 |
| FP | 49.04abc | 25.81abc | 48.98b | 41.28 |

Table 2. Cost and return analysis of different fertilizer doses and management in cauliflower at FSRD site, Goyeshpur during 2000-01 to 2002-03

| Year | Treatment | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR |
|---|---|---|---|---|---|
| 2000-01 | No | 129950 | 37998 | 91952 | - |
| | MYG + $M_1$ | 209900 | 38898 | 171002 | 87.83 |
| | MYG + $M_2$ | 223500 | 39108 | 184392 | 83.28 |
| | MYG + $M_3$ | 215750 | 38898 | 176852 | 94.33 |
| | HYG + $M_1$ | 296950 | 39074 | 257876 | 155.13 |
| | HYG + $M_2$ | 233500 | 39484 | 194016 | 68.68 |
| | HYG + $M_3$ | 278200 | 39074 | 239126 | 136.78 |
| | FP | 265200 | 39364 | 225836 | 98.01 |
| 2001-02 | No | 46350 | 38859 | 7491 | - |
| | MYG + $M_1$ | 121700 | 39853 | 81727 | 66.64 |
| | MYG + $M_2$ | 112250 | 39973 | 72397 | 65.30 |
| | MYG + $M_3$ | 87350 | 39673 | 47677 | 49.37 |
| | HYG + $M_1$ | 146150 | 40029 | 106121 | 84.30 |
| | HYG + $M_2$ | 119100 | 40209 | 78891 | 52.89 |
| | HYG + $M_3$ | 105750 | 40029 | 65721 | 49.77 |
| | FP | 129050 | 40471 | 88579 | 50.30 |

Table 2. Contd.

| Year | Treatment | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk/ha) | MBCR |
|---|---|---|---|---|---|
| 2002-03 | No | 116750 | 38979 | 77771 | - |
| | MYG + $M_1$ | 226800 | 39973 | 186707 | 109.59 |
| | MYG + $M_2$ | 253100 | 40093 | 213127 | 121.50 |
| | MYG + $M_3$ | 231750 | 39793 | 191957 | 40.28 |
| | HYG + $M_1$ | 294650 | 40149 | 254501 | 151.05 |
| | HYG + $M_2$ | 254150 | 40329 | 213821 | 100.78 |
| | HYG + $M_3$ | 251800 | 40149 | 211651 | 127.50 |
| | FP | 244900 | 40591 | 204309 | 78.50 |
| Mean | No | 97683 | 38612 | 59071 | - |
| | MYG + $M_1$ | 186133 | 39575 | 146558 | 90.85 |
| | MYG + $M_2$ | 196283 | 39725 | 156558 | 87.59 |
| | MYG + $M_3$ | 178283 | 39455 | 138828 | 94.61 |
| | HYG + $M_1$ | 245917 | 39751 | 206166 | 129.14 |
| | HYG + $M_2$ | 202250 | 40007 | 162243 | 73.96 |
| | HYG + $M_3$ | 211917 | 39751 | 172166 | 99.29 |
| | FP | 213050 | 40142 | 172908 | 74.40 |

Appendix table 1. Nutrient status of the initial soil sample (0.15cm depth) at FSRD site, Goyeshpur, Pabna

| Sample | $P^H$ | K | % total N | P | S | B | Zn |
|---|---|---|---|---|---|---|---|
| | | meq/100g soil | | microgram/100g soil | | | |
| Sample-1 | 8.5 | 0.26 | 0.07 | 6 | 5.0 | 0.60 | 0.42 |
| Critical limit | Alkaline | Medium | VL | VL | VL | Optimum | Optimum |

Appendix table 2. Yield and yield contributing characters of cauliflower with different fertilizer doses and different management

| Treatments | Plant height (cm) | Length of curd (cm) | Breath of curd (cm) | Whole plant weight (kg) | Marketable curd weight (kg) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| No | 45.40b | 6.81d | 12.36d | 1.12c | 0.63c | 23.35c |
| MYG+ $M_1$ | 57.20a | 8.49abc | 15.65bc | 1.86b | 1.25b | 45.36b |
| MYG+$M_2$ | 58.85a | 8.40abc | 15.90bc | 2.14ab | 1.33b | 50.62ab |
| MYG+$M_3$ | 57.35a | 8.13c | 15.55bc | 1.96b | 1.25b | 46.35b |
| HYG+ $M_1$ | 58.81a | 8.84a | 17.08a | 2.40a | 1.66a | 58.93a |
| HYG +$M_2$ | 57.55a | 8.46abc | 16.10ab | 2.09ab | 1.32b | 50.83ab |
| HYG +$M_3$ | 57.30a | 8.74ab | 16.07ab | 1.92b | 1.32b | 50.36ab |
| FP | 58.95a | 8.27bc | 14.90c | 2.11ab | 1.26b | 48.98b |
| CV% | 4.8 | 3.9 | 4.4 | 12.1 | 12.3 | 11.5 |

Appendix table 3. Yield and yield contributing characters of cauliflower with different fertilizer doses and different management (2000-01)

| Treatment | Curd length (cm) | Breath length (cm) | Marketable wt (kg) | Yield (t/ha) |
|---|---|---|---|---|
| No | 6.41b | 12.41b | 0.70d | 25.99d |
| MYG + $M_1$ | 7.50a | 15.70a | 1.14c | 41.98c |
| MYG + $M_2$ | 7.73a | 16.00a | 1.21bc | 44.70bc |
| MYG + $M_3$ | 7.83a | 15.30a | 1.18c | 43.15c |
| HYG + $M_1$ | 8.57a | 16.63a | 1.62a | 59.39a |
| HYG + $M_2$ | 7.57a | 15.97a | 1.22bc | 44.70bc |
| HYG + $M_3$ | 8.23a | 17.17a | 1.52ab | 55.64ab |
| FP | 8.10a | 17.03a | 1.21bc | 49.04abc |
| CV (%) | 7.2 | 7.9 | 13.7 | 13.5 |

Appendix table 4. Yield and yield contributing characters of cauliflower with different fertilizer doses and different management (2001-02)

| Treatment | Plant height (cm) | Whole plant weight (kg) | Marketable curd weight (kg) | Curd size (cm) | | Curd yield (t/ha) |
|---|---|---|---|---|---|---|
| | | | | length | breadth | |
| No | 35.00d | 0.45e | 0.25e | 4.75d | 9.57c | 9.27f |
| MYG + $M_1$ | 45.45ab | 1.09bc | 0.66bc | 7.02ab | 13.20ab | 24.34bcd |
| MYG + $M_2$ | 40.85c | 1.04bc | 0.62c | 6.48b | 12.78ab | 22.45cd |
| MYG + $M_3$ | 45.63ab | 0.75d | 0.47d | 5.68c | 11.67b | 17.47c |
| HYG + $M_1$ | 47.70a | 1.31a | 0.79a | 7.53a | 14.52a | 29.23a |
| HYG + $M_2$ | 43.85abc | 1.05bc | 0.65bc | 6.79ab | 13.62a | 23.82bcd |
| HYG + $M_3$ | 41.75bc | 0.92cd | 0.60c | 6.60b | 13.35a | 21.15de |
| FP | 45.25ab | 1.12b | 0.70abc | 6.72ab | 14.12a | 25.81abc |
| CV (%) | 5.5 | 11.8 | 11.7 | 8.3 | 8.0 | 12.3 |

**Cost of input (Tk./kg):** Urea = 5.50, TSP= 13.00, MP = 9.00, Gypsum = 3.00, Borax = 40.00, Seedling = Tk. 0.40/Seedling, Plough = Tk. 1200/ha, Labour = 200 labour/8hrs @ Tk. 60

**Price of output (Tk./kg):** Cauliflower = Tk.5.00/kg

# EFFECT OF BORON ON MUSTARD


## Abstract

A field experiment was conducted at Mymensingh Sadar and Netrakona MLT sites of Mymensingh and FSRD site Palima at Tangail during rabi season of 2002-03 to evaluate the effect of boron on the growth and yield of mustard and identify a most suitable dose of boron as well as suitable mustard variety for grater Mymensingh and Tangail. Three short duration Mustard variety (Improved Tori-7, BARI Sarisha-9 and BARI Sarisha-12) were tested against five different levels of boron (0.0, 0.5, 1.0, 1.5 and 2.0 kg/ha). Another higher level of B (2.5 kg/ha) was included at Tangail. Results revealed that at Mymensingh, application of boron increases significantly plant height, siliqua per plant, seeds per siliqua, seed yield and stover yield of Mustard. The highest seed yield was obtained from 1.5 kg B ha$^{-1}$ and the variety Improved Tori-7 gave the highest yield followed by BARI Sarisha-9. But at Palima, Tangail the highest yield was recorded from BARI Sarisha 9 and by BARI Sarisha 12 and application of B @ 1.0 kg/ha gave the highest yield which was also identical to other higher levels. From the interaction table it was found that BARI Sarisha-9 along with 1.0 kg/ha of B produced the highest seed yield of Mustard.


## Introduction

Mustard is the principal oleaginous crop of Bangladesh. It covers 58.6% of the total oilseed area and produces 52.2% of the total oilseed production in the country. The average yield of mustard per unit area in Bangladesh is very low compared with other mustard producing countries. It has been identified that micro-nutrient deficiency problem on many crops have been warranted due to intensive cropping with rice and other crops. The practice of intensive cropping with modern varieties causes a dramatic depletion of inherent nutrient reserves of some other nutrients such as S, Zn and B are being observed in many parts of the country. Boron deficiency was observed in Mustard at grater Mymensingh and Tangail district that results poor yield of Mustard. This is mainly due to less pod as well as siliqua formation. In general *Brassica* needs higher requirement of boron and they are not responding positively with lower supply, and severe deficiency may result in floral abortion and significant drop in seed production. Boron increases the number of siliqua and yield of mustard. The application of Boron in conjugation with Sulphur caused 42% increased seed yield of mustard. Recently, BARI has developed some short duration high yielding variety of Mustard which could be fits well in existing cropping pattern. The boron requirement for those varieties is not yet established across the country. The present investigation was, therefore, undertaken to evaluate the effect of boron on the growth and yield performance of mustard and to find out the suitable boron fertilizer dose for mustard and to observe if there is any genotypic difference for boron application at Mymensingh and Tangail district.

## Materials and Methods

The experiment was conducted at Mymensingh sadar and Netrakona MLT site of greater Mymensingh and FSRD site Palima at Tangail district during rabi season of 2002-03. The experiment was laid out in randomized complete block design (factorial) with 3 replications at Mymensingh and split plot design with six dispersed replications at Tangail. The factorial RCB design was followed where three varieties (Improved Tori-7, BARI Sarisha-9, & BARI Sarisha-12) and five Boron doses (0, 0.5, 1.0, 1.5, 2.0 kg B ha$^{-1}$) were combined and assigned as random. For split plot design, varieties were in main plot and boron levels were given in sub-plot. Mustard varieties Improved Tori-7, BARI Sarisha-9 and BARI Sarisha-12 were studied against five different boron levels at Mymensingh and six different levels at Tangail.

Initial soil samples were collected from both locations and analyzed for chemical characteristics of soil (Appendix Table 1) following standard methods. The plot received NPKS fertilizer as a blanket dose. Based on soil test report the plot were fertilized by the application of 100-20-50-20 kg/ha and 97-33-55-38 kg/ha of NPKS were applied at Mymensingh and Tangail, respectively. Boric acid

(ALPHA BORON) was used as the source of boron. Full amount of P, K, S, and B and half of N were applied as basal. Rest half was applied as top dress after 30 days of sowing. Recommended seed rate (8 kg $ha^{-1}$) were sown as broadcast method during October 30 to November 06 at Mymensingh and during 3rd week of November at Tangail. The crop was harvested during 4th week of January at Mymensingh and in 1st week of February at Tangail. Data on plant height, branches per plant, siliqua per plant, seeds per siliqua, seed and stover yield were recorded and the data were analyzed by using a suitable package (MSTAT) following ANOVA technique. The differences among the treatment means were evaluated by least significant difference (LSD).

## Results and Discussion

**Location: Mymensingh**

**Effect of Variety:** The yield components of mustard as influenced by different varieties were statistically significant at Mymensingh sadar but seed and stover yield were not significantly differed among each other. On the other hand, number of pod $plant^{-1}$ and seed yield significantly differed at Netrakona location. In both the locations, the variety Improved Tori-7 gave the highest yield, which was followed by BARI Sarisha-9.

**Effect of Boron:** Number of pods per plant, number of seed per pod and seed yield was responded significantly by the application of Boron fertilizers. It is observed from Table 1 that all boron applied treatment significantly gave maximum number of pods per plant. The highest number of pods was observed from 2.0 kg B/ha (55.8) which were statistically similar with other boron applied treatments but it was differed with boron less plot (42.8). The same trend was also found in case of seeds per pod. The highest number of pods was recorded from 1.5 kg B/ha (14.4) and it was statistically similar with other Boron applied plots but differed with boron less plot (12.8). The seed yield statistically significant among the treatments. The highest yield was recorded from 1.5 kg B/ha (1189 kg/ha) and it was at par with 2.0 kg B (1122 kg/ha) but significantly differed with 0.5 and 1.0 kg B/ha. The yield of without boron plot was only 887 kg/ha.

**Interaction between variety and Boron:** The interaction effect of Boron and variety for both the locations were statistically significant. The highest seed yield of mustard was recorded where Improved Tori-7 was grown with 1.5 kg B/ha (1217 kg/ha) and the lowest from BARI Sarisha-12 when grown without Born application (743 kg/ha). In case of Netrakona, the highest seed of mustard was also observed from Improved Tori-7 when grown under 1.5 kg B/ha (867 kg/ha) but the lowest from BARI Sarisha-9 when grown without Boron fertilizer (600 kg/ha). The overall yield of mustard at Netrakona was much lower than Mymensingh sadar because the crop was seriously damaged by unusual excessive rainfall during 8 and 9th November 2002. That rain could not affect Mymensingh sadar's plot because Mymensingh sowing was 6 days earlier than Netrakona.

**Economic performance:** The cost and return analysis shows that the application of 1.0 and 2.0 kg B/ha were undominated and discarded from economic study. The MRR (%) of 0.5 kg B/ha (1041% and 310% are Mymensingh and Netrakona respectively). The maximum gross margin (Tk. 23899/ha) was recorded from 1.5 kg B/ha at Mymensingh while 1.0 kg B/ha gave maximum gross margin at Netrakona.

Table 1. Yield and yield parameters of some short duration mustard varieties as influenced by various doses of boron fertilizer at Mymensingh sadar Upazila (2002-03)

| Treatment | No. of plant $m^{-2}$ | Plant height (cm) | No. of pod $plant^{-2}$ | No. of seed $pod^{-1}$ | Grain yield (kg $ha^{-1}$) | Stover yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|
| Variety | | | | | | |
| $V_1$ | 138a | 102b | 47.7b | 14.1a | 1097 | 2007 |
| $V_2$ | 130b | 108a | 59.6a | 13.9a | 1080 | 1923 |
| $V_3$ | 141a | 103b | 42.7b | 13.2b | 1035 | 2180 |
| Boron doses (kg $ha^{-1}$) | | | | | | |
| $B_1$ | 142a | 101 | 42.8b | 12.8b | 887c | 1889 |
| $B_2$ | 134bc | 101 | 50.0ab | 13.9a | 1078b | 2039 |
| $B_3$ | 135a-c | 106 | 51.2ab | 13.9a | 1078b | 1978 |
| $B_4$ | 140ab | 108 | 50.0ab | 14.4a | 1189a | 2128 |
| $B_5$ | 130c | 103 | 55.8a | 13.8a | 1122ab | 2150 |
| Variety x Boron doses (kg $ha^{-1}$) | | | | | | |
| $V_1$ x $B_1$ | 142 | 97 | 37.3f | 13.1de | 1017cd | 2117ab |
| $V_1$ x $B_2$ | 146 | 102 | 39.2ef | 14.1a-d | 1017cd | 1933ab |
| $V_1$ x $B_3$ | 135 | 102 | 54.0b-e | 14.3a-c | 1117a-c | 2033ab |
| $V_1$ x $B_4$ | 137 | 104 | 48.1c-f | 15.1a | 1217a | 2083ab |
| $V_1$ x $B_5$ | 130 | 103 | 59.8a-c | 13.8b-d | 1117a-c | 1967ab |
| $V_2$ x $B_1$ | 142 | 105 | 53.4b-e | 13.1de | 900de | 1600b |
| $V_2$ x $B_2$ | 111 | 108 | 69.5a | 14.4ab | 1133a-c | 2133ab |
| $V_2$ x $B_3$ | 131 | 108 | 57.1a-d | 13.8ab | 1033b-d | 1933ab |
| $V_2$ x $B_4$ | 141 | 111 | 50.1c-f | 14.3a-c | 1200ab | 1900ab |
| $V_2$ x $B_5$ | 124 | 107 | 67.8ab | 14.3a-c | 1133ac | 2050ab |
| $V_3$ x $B_1$ | 141 | 101 | 37.8f | 12.3c-e | 743e | 1950ab |
| $V_3$ x $B_2$ | 144 | 94 | 41.3ef | 13.3de | 1083a-c | 2050ab |
| $V_3$ x $B_3$ | 139 | 110 | 42.4d-f | 13.5b-d | 1083a-c | 2067ab |
| $V_3$ x $B_4$ | 141 | 110 | 52.0c-f | 13.7b-d | 1150a-c | 2400a |
| $V_3$ x $B_5$ | 138 | 99 | 39.8ef | 13.3c-e | 1117a-c | 2433a |
| CV (%) | 5.4 | 4.0 | 17.8 | | 10.2 | 17.2 |

Note: $V_1$ = Improved Tori-7, $V_2$ = BARI Sarisha-9 & $V_3$ = BARI Sarisha-12
$B_1$ = 0 kg B/ha, $B_2$ = 0.5 kg B/ha, $B_3$ = 1.0 kg B/ha, $B_4$ = 1.5 kg B/ha and $B_5$ = 2.0 kg B/ha

Table 2. Yield and yield parameters of some short duration mustard varieties as influenced by various doses of boron fertilizer at Netrakona MLT site, Mymensingh (2002-03)

| Treatment | No. of plant $m^{-2}$ | Plant height (cm) | No. of pod $plant^{-2}$ | No. of seed $pod^{-1}$ | Grain yield (kg $ha^{-1}$) | Stover yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|
| Variety | | | | | | |
| $V_1$ | 99 | 71 | 42.8a | 11.1 | 753a | 1640 |
| $V_2$ | 119 | 72 | 34.8b | 10.5 | 683b | 1507 |
| $V_3$ | 102 | 77 | 37.9b | 10.5 | 678b | 1630 |
| Boron doses (kg $ha^{-1}$) | | | | | | |
| $B_1$ | 95 | 72 | 38.0b | 10.6 | 644b | 1478 |
| $B_2$ | 112 | 73 | 35.4bc | 10.9 | 706ab | 1583 |
| $B_3$ | 101 | 77 | 51.1a | 10.5 | 730a | 1650 |
| $B_4$ | 112 | 73 | 36.0bc | 11.1 | 728a | 1589 |
| $B_5$ | 114 | 71 | 32.0c | 10.3 | 717ab | 1661 |

Table 2. Contd.

| Treatment | No. of plant $m^{-2}$ | Plant height (cm) | No. of pod $plant^{-2}$ | No. of seed $pod^{-1}$ | Grain yield (kg $ha^{-1}$) | Stover yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|
| Variety x Boron doses (kg $ha^{-1}$) | | | | | | |
| $V_1$ x $B_1$ | 96 | 66 | 44.4b | 11.1ab | 683bc | 1550a-c |
| $V_1$ x $B_2$ | 102 | 69 | 39.1b-d | 11.4ab | 700bc | 1450bc |
| $V_1$ x $B_3$ | 93 | 77 | 65.9a | 10.9ab | 767ab | 1817a |
| $V_1$ x $B_4$ | 110 | 74 | 39.9b-d | 11.8a | 867a | 1767ab |
| $V_1$ x $B_5$ | 95 | 67 | 24.5f | 10.3ab | 717bc | 1617a-c |
| $V_2$ x $B_1$ | 101 | 71 | 32.2d-f | 10.3ab | 600c | 1333c |
| $V_2$ x $B_2$ | 126 | 72 | 33.7c-e | 10.7ab | 718bc | 1700ab |
| $V_2$ x $B_3$ | 119 | 76 | 41.4bc | 9.9b | 733a-c | 1567a-c |
| $V_2$ x $B_4$ | 113 | 67 | 27.3ef | 10.8ab | 650c | 1317c |
| $V_2$ x $B_5$ | 134 | 73 | 39.0b-d | 10.7ab | 717bc | 1617a-c |
| $V_3$ x $B_1$ | 88 | 79 | 37.2b-d | 10.3ab | 650c | 1550a-c |
| $V_3$ x $B_2$ | 108 | 77 | 33.2c-f | 10.7ab | 00bc | 1600a-c |
| $V_3$ x $B_3$ | 91 | 76 | 45.8b | 10.8ab | 660c | 1567a-c |
| $V_3$ x $B_4$ | 113 | 79 | 40.7b-d | 10.8ab | 667bc | 1683ab |
| $V_3$ x $B_5$ | 112 | 74 | 32.5c-f | 10.0b | 717bc | 1750ab |
| CV (%) | 8.4 | 8.7 | 14.2 | 9.7 | 11.4 | 13.1 |

Note: $V_1$ = Improved Tori-7, $V_2$ = BARI Sarisha-9 & $V_3$ = BARI Sarisha-12
$B_1$ = 0 kg B/ha, $B_2$ = 0.5 kg B/ha, $B_3$ = 1.0 kg B/ha, $B_4$ = 1.5 kg B/ha and $B_5$ = 2.0 kg B/ha

Table 3. Cost and return analysis of different doses of Boron on yield of Mustard at Mymensingh and Netrakona

| Gross return (Tk./ha) | Cost of Boron (Tk./ah) | Gross margin over boron (Tk./ha) | Marginal gross margin (Tk./ha) | Additional cost of Boron (Tk./ha) | MRR (%) |
|---|---|---|---|---|---|
| Mymensingh | | | | | |
| 18685 | 0 | 18685 | 3280 | 315 | 1041 |
| 22280 | 315 | 21965 | | | |
| 22549 | 630 | 21919 | 1980 | 315 | 629 |
| 24844 | 945 | 23899 | | | |
| 23515 | 1260 | 22255 | - | - | - |
| Netrakona | | | | | |
| 13619 | 0 | 13619 | 978 | 315 | 310 |
| 14912 | 315 | 14597 | | | |
| 15425 | 630 | 14795 | 198 | 315 | 63 |
| 15355 | 945 | 14410 | - | - | - |
| 15171 | 1260 | 13911 | - | - | - |

**Location: Palima, Tangail**

**Effect of variety:** The significant effect was found on plant height. Statistically identical plant height was produced by BARI Sarisha-9 and BARI Sarisha-12 but differed with Tori-7. Yield contributing characters such as no. of branch , no. of siliqua , length of siliqua no. of seed , 1000- seed wt. and days to maturity did not show any significant effect among the varieties . Higher yield (0.98 t/ha) was observed with BARI Sarisha-9 which was followed by BARI Sarisha- 12.

**Effect of Boron:** Boron level significant effect on no. of siliqua , length of siliqua and grain yield and bio-mass (Table 1) .It was observed that the number of siliqua and length of siliqua produced significant variations among the different levels of B . Highest no. of siliqua ( 42.66 /p) and length of siliqua (4.66 cm) was obtained with 1.00 kg B /ha .

Grain and bio-mass yield produced significant variations among different levels of boron. Highest grain yield ( 0.99 t/ha ) was obtained with 1.0 kg B /ha but statistically similar to 1.5 , 2.0 and 2.5 kg B/ha . Variation was observed only in control plot. Similar trend was also observed in bio-mass production.

**Interaction effect of variety and boron:** Interaction effect was found significant except 1000 grain wt and days to maturity. The highest plant height was obtained with BARI Sarisha 9 with 1.00 kg B /ha. The highest number of branch was found with the combination of BARI Sarisha 12 with 2.0 kg /ha. Number of siliqua / plant was the highest with BARI Sarisha 9 and 1.0 kg B/ha. Length of siliqua was the highest with the combination of BARI Sarisha 12 and B level 1.0 kg/ha .Significant variation was observed in grain yield and bio-mass yield . From the interaction effect it was found that BARI Sarisha 9 and B level 1.00 kg/ha performed best among the varieties and B levels . Similar results also reported in last year. (2001-02). Grain yield was higher in variety BARI Sarisha 9 with 0.5 to 2 kg B/ha which is similar to BARI Sarisha 12 with 1 to 2.5 kg B/ha.

## Conclusion

The above result suggests that boron should be applied along with other fertilizers for the AEZ-8 area of Tangail.

Table 3. Main effect of boron level and variety on the performance of mustard, 2002-03 at Palima, Tangail

| Variety | Days to maturity | Plant height (cm ) | No. of bra./Pt. | No. of siliqua./pt . | Length of siliqua. (cm) | N0. of seed/sili. | 1000 grain wt.( g) | Grain yield (t/ha) | Bio-mass yield (t/ha ) |
|---|---|---|---|---|---|---|---|---|---|
| Tori-7 | 85 | 88 .72 | 3.65 | 33.06 | 3.91 | 9.64 | 2.63 | 0.84 | 2.91 |
| BARI Sarisha-9 | 87 | 100.8 | 4.15 | 39.51 | 4.44 | 11.12 | 4.02 | 0.98 | 3.11 |
| BARI Sarisha-12 | 85 | 100.8 | 4.16 | 38.41 | 4. 57 | 11.24 | 2.89 | 0.97 | 3.08 |
| LSD(0.05) | 3.53 | 4.69 | 0.777 | 15.56 | 0.812 | 1.82 | 3.03 | 0.13 | 0.416 |
| CV (%) | 0.05 | 4.18 | 11.56 | 12.88 | 8.67 | 15.87 | 2.39 | 5.99 | 8.43 |
| Boron Level(kg/ha) | | | | | | | | | |
| 0.00 | 86 | 95.51 | 4.10 | 33.58 | 4.12 | 9.84 | 2.74 | 0.83 | 2.91 |
| 0.50 | 86 | 94.49 | 3.84 | 31.64 | 4.17 | 10.00 | 2.77 | 0.92 | 3.25 |
| 1.00 | 86 | 97.67 | 4.20 | 42.66 | 4.66 | 11.56 | 2.72 | 0.99 | 3.04 |
| 1.50 | 86 | 97.36 | 4.02 | 39.02 | 4.32 | 11.00 | 2.73 | 0.96 | 3.00 |
| 2.00 | 86 | 97.20 | 4.04 | 39.00 | 4.35 | 10.51 | 2.73 | 0.95 | 2.92 |
| 2.50 | 86 | 98.20 | 3.73 | 36.04 | 4.22 | 11.11 | 3.16 | 0.94 | 3.08 |
| LSD(0.05) | 0.04 | 3.88 | 0.444 | 4.58 | 0.36 | 1.63 | 10.31 | 0.05 | 0.247 |
| CV (%) | 0.05 | 4.18 | 11.56 | 12.88 | 8.67 | 15.87 | | 5.99 | 8.43 |

Table 4. Interaction effect of boron level and variety on the performance of Mustard during 2002-03 at Palima, Tangail

| Variety x B level | Days to maturity | Plant height (cm ) | No. of br./Pt. | No. of Siliq./ pt | Length of siliq. (cm) | N0. of seed /sili. | 1000 grain wt. ( g) | Grain yield (t/ha) | Bio-mass yield (t/ha ) |
|---|---|---|---|---|---|---|---|---|---|
| Tori-7 | | | | | | | | | |
| 0.0 | 85 | 89.13 | 3.47 | 29.13 | 3.87 | 8.80 | 2.60 | 0.77 | 2.86 |
| 0.5 | 85 | 85.87 | 3.47 | 26.53 | 3.97 | 9.13 | 2.64 | 0.83 | 3.43 |
| 1.0 | 85 | 88.93 | 4.27 | 39.93 | 4.05 | 11.60 | 2.66 | 0.87 | 2.97 |
| 1.5 | 85 | 89.40 | 3.60 | 33.73 | 3.75 | 9.53 | 2.62 | 0.83 | 2.75 |
| 2.0 | 85 | 87.13 | 3.47 | 33.67 | 3.95 | 9.60 | 2.65 | 0.87 | 2.63 |
| 2.5 | 85 | 91.87 | 3.67 | 35.33 | 3.94 | 9.20 | 2.61 | 0.86 | 2.85 |
| BARI Sarisha-9 | | | | | | | | | |
| 0.0 | 87 | 97.27 | 4.43 | 34.63 | 4.45 | 10.50 | 2.72 | 0.87 | 2.82 |
| 0.5 | 87 | 97.73 | 3.80 | 33.27 | 4.43 | 10.50 | 2.68 | 0.98 | 3.35 |
| 1.0 | 87 | 106.40 | 4.20 | 50.30 | 4.92 | 11.10 | 2.66 | 1.07 | 3.17 |
| 1.5 | 87 | 101.70 | 4.27 | 43.93 | 4.46 | 11.70 | 2.68 | 1.03 | 3.29 |
| 2.0 | 87 | 102.40 | 4.13 | 35.73 | 4.22 | 11.30 | 2.68 | 0.99 | 3.00 |
| 2.5 | 87 | 100.10 | 4.03 | 39.20 | 4.20 | 11.70 | 2.70 | 0.95 | 3.06 |
| BARI Sarisha-12 | | | | | | | | | |
| 0.0 | 85 | 100.10 | 4.40 | 36.97 | 4.11 | 10.27 | 2.86 | 0.84 | 3.06 |
| 0.5 | 85 | 99.87 | 4.27 | 35.13 | 4.13 | 10.33 | 2.90 | 0.95 | 2.97 |
| 1.0 | 85 | 97.67 | 4.13 | 37.73 | 5.03 | 12.00 | 3.00 | 1.02 | 3.00 |
| 1.5 | 85 | 101.00 | 4.20 | 39.40 | 4.76 | 11.73 | 2.86 | 1.01 | 2.98 |
| 2.0 | 85 | 102.10 | 4.53 | 47.60 | 4.89 | 10.67 | 2.86 | 1.01 | 3.14 |
| 2.5 | 85 | 102.40 | 3.47 | 33.60 | 4.55 | 12.47 | 2.89 | 1.00 | 3.33 |
| LSD(0.05) | 0.074 | 6.73 | 0.769 | 7.995 | 0.6239 | 2.823 | 5.473 | 0.091 | 0.428 |
| CV (%) | 0.05 | 4.18 | 11.56 | 12.88 | 8.67 | 15.87 | 10.31 | 5.99 | 8.43 |

Appendix table 1. Initial status of soil at Mymensingh

| Samples | pH | OM (%) | Total N (%) | P (ppm) | K (meq $100^{-1}$ g) | S (ppm) | Zn (ppm) | B (ppm) |
|---|---|---|---|---|---|---|---|---|
| M-72 | 6.9 | 1.92 | 0.07 | 1.57 | 0.06 | 5.96 | 3.3 | 0.23 |
| Interpretation | - | - | V. L. | V. L. | V. L. | V. L. | H. | V. L. |
| M-97 | 6.1 | 1.34 | 0.08 | 4.56 | 0.16 | 9.52 | 2.2 | 0.13 |
| Interpretation | - | - | L. | V. L. | M. | V. L. | H. | L. |

V.L.=Very Low, L.=Low, M.=Medium, H.=High, V.H.=Very High

Note: M-72 and M-97 soil samples from Netrakona and Mymensingh respectively

Appendix table 2. Initial soil analysis value at Tangail

| PH | OM (%) | Total N (%) | μg/g | | | | K (meq/100 g) |
|---|---|---|---|---|---|---|---|
| | | | P | S | Zn | B | |
| 6.0<br>Slightly acidic | 1.22<br>Low | 0.08<br>Very low | 3.04<br>Very low | 16.44<br>Medium | 0.76<br>Low | 0.16<br>Low | 0.05<br>Very low |

# EFFECT OF DIFFERENT LEVELS OF BORON ON THE PERFORMANCE OF PAPAYA


## Abstract

The experiment was conducted at MLT site Modhupur, Tangail during 2002-2003 to evaluate the response of boron application on Papaya (cv. Shahi) and to find out an optimum dose of boron for Tangail. Six boron levels viz. 0.0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 kg B / ha were tested. The experiment was laid out in a randomized block design with six dispersed replications. The yield of fruit was influenced by the application of boron fertilization. The highest fruit yield was recorded from the application of 20. kg/ha of B, however, it was also identical to 2.5 and 1.5 kg/ha of B as well. The lowest yield was (40.81 t/ha) obtained from control plot. Individual fruit weight, fruit yield/plant and other yield attributes almost follow the same trend.


## Introduction

Papaya (*Carica papaya* L.) is nutritional and rich quick growing fruit in Bangladesh. It can be eaten as fruit and also used as vegetables. Bangladesh produces 39,000 tons of papaya from an area of about five thousand hectares of land having an average yield of 7.80 t/ha (BBS, 1998), which is the lowest among the papaya growing countries of the world. This is due to the poor management practices and imbalanced fertilization of the crop. Both macro-and micro- nutrients have important role on the production of papaya (Lokhande and Moghe, 1991). Papaya is intensively grown in Modhupur Tract under AEZ 28.Boron deficiency has an effect on papaya production. Soil test value indicated that Modhupur tract is low (0.06 ppm) in boron. Due to boron deficiency Papaya was deformed in shape and size. But farmers do not use boron fertilizer for papaya cultivation. As a result farmers are not getting full benefit from papaya cultivation. It is known that boron is the important factor for attractive shape, size and quality for Papaya, which can be also increased yield, quality and production of Papaya. Hence, the study was undertaken with the objectives to observe the response of papaya to added boron and to find out the optimum dose of boron for Papaya cultivation.

## Materials and Methods

The trial was carried out in Multilocation Testing site, Modhupur, Tangail during 2002-03 to evaluate the response of boron on papaya (cv. Shahi). Before conducting the field experiment soil samples were collected from experimental plot and its chemical analysis was done. Data indicate that $p^H$ of the oil sample was acidic (5.0), organic matter content was low (1.12), total N (%) was low(0.10),P was very high(74.63µg/g),K was medium (0.19meq/100g) and B was very low (0.06µg/g) in Table 2. The experiment was laid out in a randomized complete block design having seven treatments replicated in 4 times. Boron levels were 0.0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 kg/ha applied from boric acid. A blanket dose of 622-221-562-110-136 NPKSZn kg/ha was also applied (Technology Hand Book, BARI, 2002) .Full dose of TSP was applied during the final land preparation. One half of potassium and full dose of boron mixed well with soil applied in hole .One half of the urea and one fourth of potassium were applied around the young plant and covered with soil at two months after planting. The remaining nitrogen and potassium were applied around the young plant and covered with soil at four months after planting. Each plot measured 10 m x 8 m with 1 m drain between plots. Two month old seedlings were transplanted in 7$^{th}$ March, 2002 with a spacing of 3 m x 2m in between rows plants.

Four weeding, two irrigations and three times earthing up were done during the crop growth. Borthomixture and Dithane M-45(0.2%) were sprayed three times as preventive and plant protection measures for root rot and pests. Harvesting started from 2nd week of November and continued up to March /2003. Data on plant height, fruits per plant, fruit size and weight, yield per hectare were recorded and were analyzed statistically. Duncan's Multiple Range Test (DMRT) was used to determine the significant differences among the treatments.

## Results and Discussions

All the studied characters were significantly influenced by the application of B. The tallest plant (185.7 cm) was obtained from $T_5$, though superior to other treatments but did not differ significantly except control. The smallest plant height (180.6 cm) was obtained from control. The no. of fruit increased with the increase of B level up to 2.0 kg/ha than decreased gradually (Table 1). The highest number of fruits/plant (23.08) was obtained from B level 2.0 kg/ha, which was significantly different from others. Control produced the lowest number of fruits. The highest length (20.52 cm) of fruit was recorded in $T_5$ which was statistically identical with $T_4$ and $T_6$ but significantly differed with others. The minimum length (16.33 cm) was obtained from control. Similar trend was also observed in fruit breath. The highest breath (40.58 cm) of fruit was recorded from $T_5$ and the lowest breath (35.33 cm) in control .The fruit weights were significantly improved with the application of boron. Weight of fruit increased with the increased of boron level up to 2kg/ha than gradually decreased. The highest fruit weight (1.13 kg) was obtained with the treatment $T_5$ which was statistically significant with $T_{1,}$ $T_2$ and $T_3$ but identical with $T_4$ and $T_6$. The lowest fruit weight (0.91 kg) was obtained from control.

The yield of fruit was influenced by the application of boron fertilization. The lowest yield was (40.81 t/ha) obtained from control plot. The higher fruit yield was obtained from treatment $T_5$ i.e.2 kg B/ha which was statistically identical to $T_4$ and $T_6$.

From the study , it can be concluded that boron level 2.0 kg/ha along with a blanket dose of 622-221-562-110-136kg NPKSZn/ha may be optimum for the production of papaya (cv. Shahi) in Modhupur Tract. The experiment should be continued two or three year for final conclusion and recommendation.

### Farmers' reaction

1. Farmers' were interested to apply boron for papaya production
2. Uniform shape and sized of papaya was better in case of boron use.

### References

BBS, 1998. Statistical Pocket Book. Bangladesh Bureau of Statistics. Ministry of Planning, Govt. of People's Republic of Bangladesh, Dhaka

Lokhande, N.M. and P.G. Moghe.1991.Nutrients and hormonal effect on growth promotion and productivity in ring spot infected papaya crop. South India Hort.39(1): 23-26

Table 1. Yield and yield contributing characters of papaya (cv. Shahi) as influenced by different levels of boron at MLT site, Modhupur, Tangail during 2002-03

| Treatment (B kg/ha) | Plant height (cm) | Number of fruits /plant | Length of fruit (cm) | breath of fruit (cm) | wt. of fruit (kg) | Wt. of fruit (kg)/ plant | Yield (t/ha) |
|---|---|---|---|---|---|---|---|
| $T_1$ (0) | 180.6b | 16.38c | 16.33d | 35.33c | 0.91d | 16.63c | 40.81d |
| $T_2$ (0.05) | 182.2ab | 19.38b | 17.07cd | 35.90c | 0.99c | 18.56c | 48.58c |
| $T_3$ (1.0) | 183.7ab | 20.23b | 18.48bc | 37.28bc | 1.06b | 20.99b | 53.70bc |
| $T_4$ (1.5) | 183.4ab | 21.08b | 19.58ab | 38.83ab | 1.09ab | 22.62ab | 56.92ab |
| $T_5$ (2.0) | 185.7a | 23.08a | 20.52a | 40.58a | 1.13a | 23.77a | 61.44a |
| $T_6$ (2.5) | 184.0ab | 20.45b | 19.05ab | 39.25ab | 1.10ab | 22.14ab | 55.97ab |
| $T_7$ (3.0) | 181.9ab | 19.38b | 18.13bc | 38.1b | 1.07ab | 20.99b | 52.44bc |
| CV% | 1.50 | 5.92 | 5.30 | 3.74 | 3.88 | 6.43 | 7.03 |

Means followed by same letter is not significantly different at 5% level by DMRT.

Appendix table 1.Initial soil test values of the experimental plots at Modhupur, Tangail

| Crop | $P^H$ | O.M | Total N (%) | P(ug/g) | K(meq/100g) | S(ug/g) | Zn(ug/g) | B(ug/g) |
|---|---|---|---|---|---|---|---|---|
| Papaya | 5.0<br>acidic | 1.12<br>low | 0.10<br>low | 74.63<br>very high | 0.19<br>medium | 36<br>high | 1.52<br>optimum | 0.06<br>very low |

# EFFECT OF BORON ON YIELD OF THREE WHEAT VARIETIES UNDER OLD BRAHMAPUTRA FLOODPLAIN SOILS OF AEZ 9


## Abstract

A field experiment was conducted at Mymensingh Sadar MLT site during rabi season of 2002-03 to evaluate the effect of boron on the growth and yield of wheat and identify a most suitable dose of boron as well as suitable Wheat variety under Old Brahmaputra Floodplain soils of Bangladesh (AEZ 9). Three varieties of BARI released wheat viz. Kanchan, Protiva and Sourav with three doses of boron such as 0, 1.0, and 2.0 kg B ha$^{-1}$ were tested. Application of boron significantly influenced plant height, number of spike per plant, number of grain per spike and yield of grain as well as straw of Wheat. The highest grain yield was obtained from 1.0 kg B ha$^{-1}$ (4.18 t/ha) which was statistically similar with 2.0 kg B/ha (3.97 t/ha) but it was differed from the yield of without B treatment (3.56 t/ha). Regarding variety significantly higher yield was recorded from Sourav. From interaction table it was found that variety Sourav along with B @ 1.0 kg/ha produced significantly higher grain yield over other combinations.


## Introduction

In general wheat needs higher requirement fertilizers especially nitrogenous and boron and they are not responding positively with lower supply, and severe deficiency may result poor yield. Wheat is the second important cereal in Bangladesh. The average yield of wheat per unit area in Bangladesh is very low compared with other wheat producing countries. It has been identified that micro-nutrient deficiency problem on many crops have been warranted due to intensive cropping with rice and other crops. The practice of intensive cropping with modern varieties causes a dramatic depletion of inherent nutrient reserves of some other nutrients such as S, Zn and B are being observed in many parts of the country. In Mymensingh greater district, organic matter and boron content of the soil is poor for which results poor yield of wheat. The application of Boron in conjugation with Sulphur caused a certain percent increased yield of wheat. The present investigation was, therefore, undertaken to evaluate the effect of boron on the growth and yield performance of wheat and to find out the suitable boron fertilizer dose for wheat in Old Brahmaputra Floodplain soil. The main objectives were; to identify the optimum dose of Boron for wheat production in that area and to observe the yield potentiality of newly BARI released wheat varieties in that location.

## Materials and Methods

The experiment was conducted at Mymensingh sadar Upazila during rabi season of 2002-03. The experiment was laid out in randomized complete block design with 3 replications. The factorial RCB design was followed where three varieties (KANCHAN, PROTIVA and SOURAV) and three Boron doses (0, 1.0, and 2.0 kg B ha$^{-1}$) were combined and assigned as random.

Initial soil samples were collected from both locations and analyzed for chemical characteristics of soil (Appendix Table 1) following standard methods. The plot received NPKS fertilizer as a blanket dose. The plot was fertilized by the application of 100, 26, 34, and 21 kg N, P, K, and S, ha$^{-1}$ as a source of urea, TSP, MP and gypsum respectively. Boric acid (ALPHA BORON) was used as the source of boron. Full amount of P, K, S, and B and half of N were applied as basal. Rest half was applied as top dress after 23 and 40 days of sowing. Recommended seed rate (150 kg ha$^{-1}$) were sown as broadcast method on November 30, 2002. The crop was harvested on March 16, 2003. Data on plant height, spikelet per spike, grain per spike, grain and straw yield were recorded and the data were analyzed by using a suitable package (MSTAT) following ANOVA technique. The differences among the treatment means were evaluated by least significant difference (LSD).

## Results and Discussion

**Effect of Variety:** The yield components and grain yield of wheat as influenced by different varieties were statistically significant but straw yield was not significantly differed among each other (Table 1). On the other hand, number of spikelet spike$^{-1}$ was statistically identical among the varieties. The variety Sourav (4.14 t/ha) out yielded over other tested varieties such as Kanchan yielded 3.74 t/ha while Protiva gave 3.82 t/ha grain yield.

**Effect of Boron:** Plant height, number of spikelet per spike, number of grain per spike, grain and straw yield were significantly influenced by the application of Boron fertilizer (Table 1). It is observed from Table 1 that all boron applied treatment significantly gave maximum number of spikelet per spike, number of grain per spike, grain and straw yield. The highest number of spikelet per spike (16.3) was found from 1.0 and 2.0 kg B/ha plots. In the same way maximum number of grain per spike (32.7) was also found from the Boron applied treatments. The highest grain yield was obtained from 1.0 kg B $ha^{-1}$ (4.18 t/ha) which was statistically similar with 2.0 kg B/ha (3.97 t/ha) but it was differed from the yield of without B treatment (3.56 t/ha). In the same way, the highest straw yield was obtained from 1.0 kg B $ha^{-1}$ (4.27 t/ha) which was statistically similar with 2.0 kg B/ha (7.19 t/ha) but it was differed from the yield of without B treatment (6.43 t/ha).

**Interaction between Variety and Boron:** The interaction effect of Boron and variety were statistically significant (Table 1). The highest grain yield of wheat was recorded where Sourav was grown with 1.0 kg B/ha (4.50 t/ha) and the lowest from Kanchan when grown without Born application (3.48 t/ha). The overall yield of wheat at was good and farmers were impressed to see the yield potentiality of wheat in that area.

**Economic performance:** The cost and return analysis shows that the application of 2.0 kg B/ha was undominated and discarded from economic study. The MRR(%) of 1.0 kg B/ha (754%). The maximum gross margin (Tk. 36445/ha) was recorded from 1.0 kg B/ha plot (Table 2).

Table 1. Yield and yield parameters of some wheat varieties as influenced by various doses of boron fertilizer at Mymensingh sadar MLT site (2002-03)

| Variety | No. of Spike $m^{-2}$ | Plant height (cm) | No. of spikelet $spike^{-1}$ | No. of grain $spike^{-2}$ | Wt. of 1000-grain (g) | Grain yield (t $ha^{-1}$) | Straw yield (t $ha^{-1}$) |
|---|---|---|---|---|---|---|---|
| Variety | | | | | | | |
| $V_1$ | 318 | 97.4a | 16.1 | 32.4 | 44.3ab | 3.74b | 7.02 |
| $V_2$ | 316 | 95.3a | 15.7 | 31.5 | 42.3b | 3.82b | 6.82 |
| $V_3$ | 316 | 90.9b | 15.9 | 32.0 | 44.7a | 4.14a | 7.05 |
| Boron doses (kg $ha^{-1}$) | | | | | | | |
| $B_1$ | 322 | 92.0b | 15.2b | 30.5b | 44.0 | 3.56b | 6.43b |
| $B_2$ | 313 | 96.8a | 16.3a | 32.7a | 44.0 | 4.18a | 7.27a |
| $B_3$ | 316 | 94.8ab | 16.3a | 32.7a | 43.3 | 3.97a | 7.19a |
| Variety x Boron doses | | | | | | | |
| $V_1$ x $B_1$ | 320 | 95.7ab | 16.2ab | 32.4ab | 43.7ab | 3.48e | 6.64ab |
| $V_1$ x $B_2$ | 312 | 100.7a | 16.2ab | 32.7ab | 44.7a | 4.02bc | 7.55a |
| $V_1$ x $B_3$ | 323 | 95.8ab | 16.0ab | 32.1abc | 44.7a | 3.72cde | 6.88ab |
| $V_2$ x $B_1$ | 322 | 94.1b | 14.9bc | 29.9bc | 43.3ab | 3.56de | 6.37ab |
| $V_2$ x $B_2$ | 316 | 94.9ab | 16.0ab | 32.1ab | 43.3ab | 4.01bc | 6.77ab |
| $V_2$ x $B_3$ | 311 | 96.9ab | 16.3ab | 32.5ab | 40.3b | 3.90bcd | 7.31ab |
| $V_3$ x $B_1$ | 323 | 86.3c | 14.3c | 29.1c | 45.0a | 3.63cde | 6.27b |
| $V_3$ x $B_2$ | 311 | 94.7ab | 16.6a | 33.4a | 44.0ab | 4.50a | 7.49a |
| $V_3$ x $B_3$ | 313 | 91.7bc | 16.7a | 33.6a | 45.0a | 4.29ab | 7.39ab |
| CV (%) | 4.6 | 3.7 | 5.6 | 5.5 | 5.1 | 5.9 | 10.1 |

Note : $V_1$ = Kanchan, $V_2$ = Protiva and $V_3$ = Sourav
$B_1$ = 0 kg B/ha, $B_2$ = 1.0 kg B/ha, and $B_3$ = 2.0 kg B/ha

Table 2. Cost and return analysis of different doses of Boron on yield of Wheat at Mymensingh sadar during 2002-03

| Treatment (B kg/ha) | Gross return (Tk./ha) | Cost of Boron (Tk./ha) | Gross margin over Boron (Tk./ha) | Marginal gross margin (Tk./ha) | Additional cost of Boron (Tk./ha) | MRR (%) |
|---|---|---|---|---|---|---|
| $B_1$ | 31695 | 0 | 31695 | 4750 | 630 | 754 |
| $B_2$ | 37075 | 630 | 36445 | -- | -- | -- |
| $B_3$ | 35355 | 1260 | 34095 | | | |

Appendix table 1. Initial status of soil samples

| Samples | pH | OM (%) | Total N (%) | P (ppm) | K (meq $100^{-1}$ g) | S (ppm) | Zn (ppm) | B (ppm) |
|---|---|---|---|---|---|---|---|---|
| M-94 | 6.1 | 1.22 | 0.12 | 1.55 | 0.12 | 14.28 | 3.0 | 0.26 |
| Interpretation | - | - | L. | V. L. | L. | L. | H. | L. |

V.L.=Very Low, L.=Low, M.=Medium, H.=High, V.H.=Very High

# EFFECT OF N SOURCE ON T.AUS AND T.AMAN RICE IN GANGES TIDAL FLOOD PLAIN ZONE (AEZ-13)


## Abstract

The experiment was conducted at FSRD site, Lebukhali, Patuakhali in 2002 to find out suitable source of N fertilizer for higher yield and N use efficiency. The result of one year experiment reveals that in case of T.Aus statistically identical yield was obtained from urea mega granule (UMG), urea super granule (USG) and prilled urea but in case of T.Aman the highest grain yield was obtained from prilled urea. Application of granular urea instead of prilled urea did not show any significant effect on T.Aus and T.Aman rice at Lebukhali, Patuakhali.


## Introduction

The efficiency of nitrogen as urea is very less in T.Aus and T.Aman rice in Ganges Tidal Floodplain (AEZ 13). One of the reasons for less efficiency is assumed that it might be lost due to field inundation and water receding effect by tidal water. Therefore, response of T.Aus and T.Aman rice to nitrogen is very less. But recently, in our country different types of fertilizer materials are becoming available in the market. Urea super granule (USG) is one of the popular nitrogenous fertilizer which is now available in the market and the farmers are already using in the Boro rice. Farmers' are now also using it in different upland vegetables and crops such as, Brinjal, Cabbage, Cauliflower, Banana etc. The efficiency of nitrogen as USG is higher than prilled urea. Therefore, deep placement of granular form of nitrogen (USG & UMG) might increase the nitrogen use efficiency by crops and thereby increased crop yield in Ganges Tidal Floodplain (AEZ). With this view the experiment was carried out to evaluate N use efficiency by using granular urea in T.Aus and T.Aman.

## Materials and Methods

The experiment was conducted at FSRD site, Lebukhali, Patuakhali in 2002. Four treatments of different sources of N with five dispersed replication was set in RCB design. Three different sources of N fertilizers viz. UMG, USG and prilled urea were tested along with control. The rate of N was 80 kg/ha. Other fertilizer was applied as per FRG'97. One UMG was applied for four hills and one USG was applied for two hills. Prilled urea was applied half as basal dose and half as top dress. About 30-35 days old seedling was transplanted with a spacing 25 x 15 cm for T.Aus and 30 x 20 for T.Aman. All other intercultural operation was done as required.

## Result and Discussion

### T.Aus

Grain yield of T.Aus rice did not vary significantly due to different sources of N except with no fertilizer treatment. The efficiency of granular urea over prilled urea was not evident. Panicles/m$^2$, filled grain /panicle and 1000 seed weight also showed similar result.

### T.Aman

In T.Aman rice significantly higher grain yield was obtained from prilled urea. Granular urea failed to show significant response over prilled urea. However, panicles/m2, filled grain/panicle and 1000-grain weight did not vary significantly among the different sources of N fertilizer. Yield obtained from USG and UMG was statistically identical.

However, this is the result of 1$^{st}$ year only and the experiment should be continued for another two years for confirmation of the findings.

Table 1. Effect of N source on yield and yield contributing characters of T.Aus at Lebukhali, Patuakhali during 2002

| Treatment | Panicle/$m^2$ | Filled grain/ panicle | Unfilled grain/ panicle | 1000 grain weight (gm) | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| Urea Mega Granule | 145a | 95a | 12 | 28.8a | 3982a |
| Urea Super Granule | 148a | 92a | 10 | 28.8a | 3810a |
| Normal Urea | 147a | 94a | 9 | 28.8a | 3920a |
| Control | 131b | 72b | 15 | 27.5b | 2620b |
| CV (%) | 4.51 | 6.02 | | 0.76 | 8.11 |

Table 2. Effect of N source on yield and yield contributing characters of T.Aman at Lebukhali, Patuakhali during 2002

| Treatment | Panicle/$m^2$ | Filled grain/ panicle | Unfilled grain/ panicle | 1000 grain weight (gm) | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| Urea Mega Granule | 162b | 72a | 14 | 30.1a | 3446b |
| Urea Super Granule | 163b | 74a | 13 | 30.0b | 3570b |
| Normal Urea | 177a | 76a | 11 | 30.3a | 3720a |
| Control | 149c | 63b | 17 | 28.4c | 2642c |
| CV (%) | 7.52 | 4.83 | | 2.01 | 11.99 |

# STUDY ON THE PERFORMANCE OF WHEAT VARIETIES DEVELOPED BY BARI


## Abstract

On-farm performance of wheat varieties was evaluated at Gangni and Gabtali multilocation testing sites during rabi seasons of 2001 to 2003 to find out suitable variety of wheat. Five varieties viz. Satabdi, Protiva, Gourab, Sourav and Kanchan were evaluated in RCB design with three dispersed replication in each site. Results revealed that Satabdi produced significantly highest yield at both sites, which was 9-13% higher yield than Kanchan at Gagni and 21% at Gabtali, which is currently used by the farmers.


## Introduction

Wheat is successfully grown in about 18000 ha area in Meharpur and Chuadanga district. These are the most potential area for wheat cultivation. Wheat is grown in this area intensively following the improved cropping pattern Wheat-Jute /Aus-T.Aman rice. But most of the farmers use the variety Kanchan at all sites. The yield of Kanchan is decreasing gradually. Recently the Wheat Research Center (WRC) of BARI has developed four new varieties with considerable yield advantage over Kanchan. It is therefore necessary to test the performance of these new varieties against Kanchan for improvement of the cropping pattern.

## Materials and Method

The experiment was conducted at Gangni MLT sites, Kushtia and Gabtali MLT sites, Bogra at the farmers' field in rabi season of 2002-03. The experiment was laid out in randomized complete design with six dispersed replications in each site. The tested varieties were Satabdi, Kanchan, Protiva, Sourav and Gourab. The seeds were sown in line at 20 cm apart. Sowing date was 22 Nov to 18 Dec. 2001& 2002 at Kushtia and 2-10 December '02 at Bogra. Fertilizer used at the rate of 120-60-40-20-5-1 kg N, $P_2O_5$, $K_2O$, S, Zn and B from urea, triple super phosphate, muriate of potash, gypsum zinc sulphate and boric acid and 5 ton cowdung per hectare. Full amount of P K S Zn and B and half of the urea was applied at the time of land preparation and the rest of the N was applied at first irrigation time. Three times irrigation was given. Plant protection measure was taken. The crop was harvested at 15-30 March, 2002 & 2003 at Kushtia and 15-26 March 2003 at Bogra. Necessary data were collected and analyzed.

## Results and Discussion

### Gagni MLT site, Kushtia

Grain/spike, spikes/m$^2$, grain and straw yields were significantly affected by variety in 2001-02 but similar trend was observed in 2002-03 except plant height and grain weight which was differ significantly. In 2001-02, Satabdi and Protiva showed identified grain/spike but Satabdi, Protiva and Gourab gave statistically similar spike/m$^2$. Grain weight was statistically at par but Satabdi showed higher grain weight. Significantly highest grain yield was obtained from variety Satabdi which might be due to higher no. of grains/spike and spikes/m$^2$. In case of straw yield, Satabdi and Protiva showed identical (Table 1).

During 2002-03, Crop duration took 15 days more in the year than previous year. Spikes/m$^2$ showed identical in variety Satabdi and Protiva and higher than other variety. No. of grains/spike were statistically identical is all varieties except Sourav which showed lower grains/spike. The higher grain weight was recorded from variety Satabdi which was at par to variety Protiva. Significantly highest grain yield was obtained from variety Satabdi which could be due to higher spikes/m2 and grain weight (Table 2). Similar trend was followed in case of straw. On an average, highest grain yield was recorded from variety Satabdi which was 9% higher yield than Kanchan which was currently used by the farmers.

**Gabtali MLT sites, Bogra**

Grain, straw yield and yield attributes were significantly influenced by variety. Higher no. of grains/spike was obtained from variety Akbar which was at par to Satabdi, Gourab and Sourab but grain weight showed higher in variety Gourab, Protiva and Sourab. Significantly highest grain yield was recorded from variety Satabdi which was 20% higher yield than Kanchan. Straw yield also showed higher from variety Satabdi but statistically identical to Sourab.

**Farmers Reaction**

In those five varieties, Satabdi is found better but in context of bread wheat but Protiva variety is more soft and tasty.

Table 1. Yield and yield attributes of different wheat varieties at Gangni MLT site in 2001-02

| Variety | Crop duration (days) | Plant height (cm) | Spike/m$^2$ (No.) | No. of grains /spike | 1000-grain wt (gm) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Satabdi | 102 | 107.3 | 353a | 32a | 45.00 | 4.57 a | 6.64a |
| Protiva | 102 | 107.3 | 349ab | 32a | 44.67 | 4.47 b | 6.51ab |
| Gourab | 100 | 104.3 | 337abc | 31b | 43.67 | 4.27 c | 6.25bc |
| Sourav | 100 | 104.3 | 328bc | 30b | 42.67 | 4.20 d | 6.09cd |
| Kanchan | 104 | 104.3 | 327bc | 30b | 42.67 | 4.00 e | 6.00d |
| F-test | NS | NS | * | ** | NS | ** | ** |
| CV (%) | 2.0 | 2.5 | 1.8 | 2.1 | 2.0 | 0.7 | 1.5 |

Table 2. Yield and yield attributes of wheat varieties at Gangni MLT site in 2002-03

| Variety | Crop duration (days) | Plant height (cm) | Spike/m$^2$ (No.) | No. of grains /spike | 1000-grain wt (gm) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Satabdi | 117 | 103.4 | 326 | 31 | 46.33 | 4.58 | 6.96 |
| Protiva | 117 | 102.5 | 322 | 30 | 45.83 | 4.35 | 6.59 |
| Gourab | 114 | 101.6 | 308 | 30 | 45.17 | 4.08 | 6.41 |
| Sourav | 114 | 101.8 | 297 | 29 | 43.83 | 3.91 | 6.17 |
| Kanchan | 119 | 101.9 | 307 | 30 | 44.67 | 4.17 | 6.40 |
| LSD (0.05) | NS | 1.65 | 9.90 | 1.26 | 0.82 | 0.12 | 0.19 |
| CV (%) | 2.0 | 1.34 | 1.84 | 3.48 | 1.52 | 2.27 | 2.41 |

Table 3. Yield and yield attributes of wheat varieties at Gabtali MLT site, Bogra during 2002-03

| Variety | Crop duration (days) | Plant height (cm) | No. of grains /spike | 1000-grain wt (gm) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|
| Satabdi | 109a | 92.72a | 39a | 40.88a | 4.01a | 5.33a |
| Protiva | 105bc | 82.70c | 32b | 37.36abc | 3.08d | 4.22b |
| Gourab | 106b | 84.88b | 36ab | 39.79ab | 3.32bc | 4.45bc |
| Sourav | 104d | 84.73b | 37a | 37.18bc | 3.53b | 4.95a |
| Kanchan | 104cd | 83.67b | 36cd | 34.78a | 3.20c | 4.20b |
| Akbar | 105cd | 10.28ab | 39a | 35.13c | 2.90e | 4.30b |
| F-test | * | * | * | * | * | * |
| CV (%) | 1.09 | 4.35 | 9.67 | 8.16 | 5.39 | 7.09 |

# PERFORMANCE OF DIFFERENT CHICKPEA VARIETIES

**Abstract**

An experiment was carried out at FSRD site Golapgonj, Sylhet and MLT site Moulvibazar to find out the yield and suitability of chickpea variety(s) after harvest of T.Aman rice. Six BARI developed Chickpea varieties (BARI Chola 2, 3, 4, 5, 6 & 7) were evaluated. On an average, BARI Chola-3 gave the highest yield, which attributed maximum pods/plant and relatively bigger seed size at Golapganj. Annigeri variety was used during 2002-03 at both the sites which performed better at Golapganj but BARI Chola-3 at Moulvibazar.

## Introduction

Pulses can utilize limited soil moisture and nutrients more efficiently than cereal. A vast area of land remains fallow for a long time (December-May) after the harvest of aman rice due to moisture stress. Chickpea is a drought tolerant and deep rooted crop, so which can play a major role in acquisition of both water and nutrient from below the soil surface. In order to increase pulse production, chickpea may be introduced in the existing fallow period. Therefore, the present experiment was undertaken to find out the yield and suitability of chickpea variety(s) after harvest of T.Aman rice.

## Materials and Methods

The experiment was conducted in rainfed condition at the FSRD site Golapgonj, Sylhet and MLT site Moulvibazar during the period from November, 2001 to March, 2003. Six chickpea varieties viz. BARI Chola-2, BARI Chola-3, BARI Chola-4, BARI Chola-5, BARI Chola-6 and BARI Chola-7 during 2001-02 and one more variety Annigeri in 2002-03 were used in the experiment. Treatments were arranged in the RCB design with three replications. The plot size was 4 m × 3 m. Fertilizers were applied at the rate 20-40-20kg/ha of N, $P_2O_5$ and $K_2O$, respectively. The seeds were sown on 25 November, 2001 at both sites and 2-8 December 2002 at FSRD, Golapganj and MLT site, Moulvibazar. Spacing was 40 cm × 10 cm.

## Results and Discussion

### FSRD site, Golapganj, Sylhet

The results revealed that there were significant variations in all the characters under studied except seeds/pod. The days to maturity ranged from 114 DAS to 120 DAS. The earliest variety was BARI Chola-4 and BARI Chola-2. Significantly the highest pods/plant was recorded from BARI Chola-3 and the lowest from BARI Chola-4. There was no significant difference among the varieties in terms of seeds/pod. The highest seed weight recorded from BARI Chola-3 followed by Annigeri but minimum weight from BARI Chola-5 & 7.

Variety Annigeri showed the highest yield but statistically at par to BARI Chola-3. The highest seed yield might be due to maximum no. of pods/plant and 100- seed weight.

### MLT site, Moulvibazar

Maturity, pods/plant, 100-seed weight and yields were significantly differed by variety. The longest duration was recorded from BARI Chola-3 and shorter from BARI Chola-2 and BARI Chola-4. The highest pods/plant was obtained from BARI Chola-3 followed by Annigeri. Seeds/pod was not influenced by variety. The variety Annigeri and BARI Chola-3 showed similar seed weight and higher yield than other varieties. Significantly the highest yield was recorded form BARI Chola-3 due to higher pods/plant and seed weight.

On an average of two years result showed that BARI Chola-3 gave higher yield at Moulvibazar but variety Annigeri gave higher yield during 2002-03 at Golapganj. So, the trial may be repeated from another year for confirmation.

Table 1. Yield and yield contributing characters of seven chickpea varieties at FSRD site, Golapganj, Sylhet during rabi, 2002-03

| Variety | Days to maturity | Pod/plant | Seeds/pod | 100 seed wt (g) | Yield (kg/ha) | |
|---|---|---|---|---|---|---|
| | | | | | 2001-02 | 2002-03 |
| Annigeri | 120 | 34.63 | 1.24 | 17.1 | - | 1569 |
| BARI Chola-2 | 114 | 25.40 | 1.19 | 14.9 | 856 | 920 |
| BARI Chola-3 | 121 | 31.15 | 1.21 | 17.6 | 1406 | 1522 |
| BARI Chola-4 | 114 | 21.03 | 1.19 | 13.1 | 782 | 766 |
| BARI Chola-5 | 120 | 23.55 | 1.27 | 12.2 | 1010 | 863 |
| BARI Chola-6 | 116 | 24.42 | 1.17 | 14.4 | 858 | 984 |
| BARI Chola-7 | 119 | 22.25 | 1.21 | 12.3 | 702 | 779 |
| $LSD_{0.05}$ | 1.96 | 2.49 | NS | 0.49 | 112.0 | 62.73 |

Table 1. Yield and yield contributing characters of seven chickpea varieties at MLT Site, Moulvibazar during rabi, 2002-03

| Variety | Days to maturity | Pod/plant | Seeds/pod | 100 seed wt (g) | Yield (kg/ha) |
|---|---|---|---|---|---|
| Annigeri | 119 | 35.96 | 1.27 | 17.65 | 1516 |
| BARI Chola-2 | 115 | 22.05 | 1.21 | 14.23 | 892 |
| BARI Chola-3 | 121 | 38.04 | 1.23 | 17.75 | 1605 |
| BARI Chola-4 | 115 | 19.42 | 1.17 | 13.20 | 790 |
| BARI Chola-5 | 121 | 21.99 | 1.24 | 12.26 | 654 |
| BARI Chola-6 | 116 | 28.00 | 1.19 | 15.11 | 1014 |
| BARI Chola-7 | 118 | 25.04 | 1.21 | 12.39 | 738 |
| $LSD_{0.05}$ | 2.81 | 7.38 | NS | 1.93 | 32.05 |

# INFLUENCE OF DIFFERENT TILLAGE METHODS ON THE PERFORMANCE OF CHICKPEA UNDER T.AUS-T.AMAN-FALLOW CROPPING PATTERN


## Abstract

A field experiment was conducted at FSRD site Golapganj, Sylhet during rabi season 2001-03 to evaluate effect of tillage methods on two chickpea varieties in fallow period. Treatments included were (a) variety two: BARI Chola-2 and Annigeri in 2001-02 and one more variety BARI Chola-5 in 2002-03 and (b) tillage practice viz. conventional and deep. The variety Annigeri coupled with deep tillage produced the highest yield (1965 kg/ha). Deep tillage performed higher yield than that of conventional tillage. Tillage treatment did not show appreciable difference in soil moisture.


## Introduction

In Bangladesh chickpea is grown primarily as a rainfed crop. The success of this crop depends on the exploitation of residual soil moisture. Farmers usually broadcast seeds, which leads to irregular germination due to less seed soil contact and soil moisture stress. Generally chickpea is often established with conventional tillage. In the Surma-Kushyara floodplain the soil is characterized by hard pan beneath the plough layer. In the post rainy season only the residual soil moisture above the plough pan is available for crop growth and at this situation soil water is limited to support the requirement of any crop. In this contest, breaking of plough pan might allow penetration of roots down the profile and thereby, allow extraction of greater volume of water and nutrient from the deeper zone. This study was undertaken to evaluate the feasibility of growing chickpea in post rainy season fallow period and to investigate the effect of tillage methods on two chickpea genotypes.

## Materials and Methods

A field experiment was conducted at FSRD site, Golapganj, Sylhet during rabi season of 2001-03. There were two treatment viz. methods of tillage and varieties of chickpea in the experiment. Methods of tillage were conventional and deep. Conventional tillage was done by country plough while deep tillage was done by spading. About 7-8 cm deep ploughing was maintained by country plough but in case of deep ploughing 18-20 cm depth was maintained. Two varieties of chickpea BARI Chola-2 and Annigeri in 2001-02 and one more variety BARI Chola-5 in 2002-03 were used in the experiment. The experiment was conducted using a RCB (control) design with four replications. Unit plot size was 4 m × 3 m. Spacing was 40 cm × 10 cm. Fertilizer at the rate of 20-40-20-20 kg/ha of N, $P_2O_5$, $K_2O$ and S was applied .The seed was sown on 29 November, 2001. The crop was grown under rainfed condition. The rainfall occurred during October and November, 2001 was 308.9 mm and 21 mm, respectively, where 68.2 and 132.2 mm in November 2002 and during crop growing period (December-March) was 83 mm in 2001-02 and 243.2 mm in 2002-03. Pod borer was minimized by spraying of insecticides and also by hand picking. Soil moisture was monitored by 10 days interval throughout the crop growth period up to a depth of 45 cm with intervals of 15cm. The crop was harvested on 24-25 March, 2002 and last week of March, 2003.

## Results and Discussion

Soil moisture percentage varied at sowing to harvest but storage moisture tended to increase with depth (Figure 1). It also showed that with the increment of time soil moisture status within the same depth moved to decrease gradually. Moisture decreased sharply after 62DAS particularly on 0-15 cm and 15-30 cm soil depths. The difference between the moisture curves of conventional and deep tillage is narrow.

### Effect of tillage method

Pods/plant and seed yields were significantly influenced by tillage method but maturity days, plant height and 100-seed weight were not significantly influenced. Deep tillage showed significantly higher yield due to higher no. of pod/plant.

**Effect of variety**

Plant height, pods/plant, 100-seed weight and seed yields were significantly affected by different variety. The BARI Chola-2 showed significantly higher plant height than Annigeri but pods/plant and 100-seed weights were significantly higher than BARI Chola-2. Significantly the highest seed yield was recorded from variety Annigeri due to higher pods/plant and 100-seed weight (Table 1). BARI Chola-5 included in 2002-03 but failed to show higher yield than BARI Chola-2 and Annigeri.

**Interaction between tillage method and variety**

Plant height, pods/plant, 100-seed weight and seed yields were significantly influenced by different tillage method and variety. Plant height was higher from $M_2V_1$ which was statistically at par to $M_2V_2$. The variety Annigeri with deep tillage showed higher pods/plant but statistically identical to same variety with conventional tillage. But 100-seed weights were the highest from deep tillage with variety Annigeri but at par to conventional tillage of same variety. The highest seed yield was recorded from deep tillage with Annigeri. The highest yield could be attributed to high number of pods/plant and higher 100-seed weight and this advantage were achieved through better utilization of soil moisture and nutrients. On an average, higher seed yield was obtained from deep tillage with Annigeri variety. BARI Chola-5 failed to show higher yield in either of tillage method. Two years result showed that deep tillage with Annigeri variety could be grown in Sylhet region.

Table 1. Yield and yield contributing character of chickpea as affected by variety and tillage methods during rabi, 2001-02 & 2002-03

| Treatment | Plant height (cm) | Pod/plant | 100-seed weight (g) | Yield (kg/ha) | |
|---|---|---|---|---|---|
| | | | | 2001-02 | 2002-03 |
| Tillage Method | | | | | |
| Conventional ($M_1$) | 34.07 | 28 | 14.69 | 1076 | 1055 |
| Deep ($M_2$) | 35.64 | 33 | 14.90 | 1236 | 1130 |
| $LSD_{0.05}$ | NS | 2.77 | NS | 105.8 | 32.15 |
| Variety | | | | | |
| BARI Chola-2 ($V_1$) | 37.20 | 27 | 14.73 | 979 | 912 |
| Annigeri ($V_2$) | 36.09 | 38 | 17.68 | 1333 | 1597 |
| BARI Chola-5 ($V_3$) | 31.33 | 26 | 11.98 | - | 770 |
| $LSD_{0.05}$ | 1.13 | 3.39 | 0.47 | 105.8 | 39.40 |
| Tillage method × Variety | | | | | |
| $M_1V_1$ | 36.03 | 26 | 17.77 | 890 | 879 |
| $M_2V_1$ | 38.38 | 29 | 14.69 | 1068 | 944 |
| $M_1V_2$ | 35.05 | 35 | 17.45 | 1262 | 1545 |
| $M_2V_2$ | 37.03 | 40 | 17.91 | 1405 | 1650 |
| $M_1V_3$ | 31.13 | 24 | 11.84 | - | 743 |
| $M_2V_3$ | 31.53 | 27 | 12.10 | - | 798 |
| $LSD_{0.05}$ | 1.61 | 4.78 | 0.67 | 211.6 | 55.70 |

Table 2. Physical and Chemical properties of the experimental site

| Properties | Depth of soil layers (cm) | | | |
|---|---|---|---|---|
| | 0-15 | 15-30 | 30-45 | 45-60 |
| Soil pH (Initial) | 5.1 | 7.3 | 7.6 | 7.8 |
| Soil pH (Harvesting stage) | 6.1 | 7.1 | 7.6 | - |
| Bulk density | 1.53 | 1.45 | 1.46 | 1.42 |
| Organic matter (%) | 0.94 | 0.74 | 0.60 | 0.60 |
| N (Total %) | 0.12 | 0.17 | 0.13 | 0.15 |
| P (ppm) | 3.10 | 1.55 | 1.50 | 1.52 |
| K (meq./100 g soil) | 0.06 | 0.18 | 0.12 | 0.11 |
| B (ppm) | 0.30 | 0.34 | 0.42 | 0.38 |

# EFFECT OF PLANTING TIME ON THE PERFORMANCE OF BUSHBEAN


## Abstract

An experiment was conducted at ARS, Comilla in 2002-03 and OFRD, ARS, BARI, Rangpur to determine the optimum range of planting for BARI Bushbean-1. It revealed that BARI bushbean-1 gave the highest marketable green pod yield from Dec. 12 sowing (15 t/ha) followed by Dec. 2 sowing (13 t/ha) at Comilla but 25 October and 25 December sowing gave higher benefit at Rangpur.


## Introduction

Bushbean a newly introduced vegetable is grown in Bangladesh in a limited scale. The only variety BARI Bushbean-1 is available which a short duration crop with highly synchronous bearing. Bushbean is a potential crop with high yield potential. So, an experiment was undertaken to find out the optimum time of sowing of BARI Jharseem-1 for higher yield at Barisal and Bogra region.

## Materials and Methods

The experiment was conducted at ARS, Comilla during rabi season from 2002-03. The experiment was laid out in Randomized complete block Design with 3 replications. The unit plot size was 9 sq. m. Five sowing dates Nov. 21, Dec. 2, 12 and Jan. 2 were tested at Comilla but 9 sowing dates (15 October to 5 January) at an interval of 10 days at Rangpur. The land was thoroughly prepared and fertilization was done with cowdung, Urea, TSP, MP @ 10 t/ha, 25 N, 75 $P_2O_5$ and 90 $K_2O$ kg/ha, respectively. The variety of crop was BARI-Jharseem-1 and plant spacing was 40 cm x 15 cm. Irrigation and other intercultural operation was done when necessary. Plant/plot, plant height, number of pod per plant, length of pod, harvesting date and marketable yield were recorded and analyzed statistically.

## Results and Discussion

### ARS, Comilla

Plants/plot, pods/plant, length and weight of pod and pod yields were significantly influenced by different dates of sowing (Table 1). Higher no. of pods/plant was obtained from December 12 which was statistically identical to December 2 and November 21 sowing. Pod weight and pod length was not statistically influenced. The highest pod yield was obtained from December 12 sowing closely followed by December 2 sowing. The result showed that Bushbean could be grown from December 2 December 12 sowing at Comilla but it needs another year trial for confirmation.

### OFRD, ARS, Rangpur

Sowing time had significant effect on all characters studied. Plant height was almost similar except 5 January sowing which showed the lowest height. Plants/$m^2$ was the lowest from October sowing and other were similar. Pods/plant showed similar except 25 October and 5 January sowing. Five November sowing showed higher edible green pod yield but statistically identical 15 November to 15 December sowing. Early sowing (October) failed to show higher yield and similar in the case of January sowing.

Table 1. Mean performance of Bushbean cv. BARI Jharseem-1 at different sowing dates at level Barind soil of ARS, Comilla during 2002-03

| Sowing time | Plant/$m^2$ | Pod/plant | Pod length (cm) | Pod weight (g) | Yield (kg/ha) |
|---|---|---|---|---|---|
| 21 November 2002 | 12.42b | 12.39ab | 12.13 | 6.12 | 10.66ab |
| 02 December 2002 | 13.08ab | 12.69ab | 12.47 | 6.21 | 12.94ab |
| 12 December 2002 | 14.92a | 12.94a | 12.87 | 7.30 | 15.25a |
| 22 December 2002 | 13.42ab | 9.53bc | 11.67 | 6.68 | 10.83ab |
| 02 January 2003 | 13.17ab | 7.65c | 11.53 | 6.73 | 7.48b |
| LSD (0.05) | 1.85 | 3.2 | NS | NS | 5.7 |
| CV (%) | 13.6 | 12.7 | 8.3 | 6.3 | 11.9 |

Table 2. Yield and yield contributing characters of Bushbean as influenced by different planting time at OFRD, ARS, BARI, Rangpur during rabi, 2002-03

| Planting date | Plant /$m^2$ at harvest (no.) | Plant height at harvest (cm) | Pod/plant (no.) | Pod length (cm) | Pod diameter (cm) | Edible green pod yield (t/ha) |
|---|---|---|---|---|---|---|
| October 15 | 6.4d | 41.8a | 11.3bc | 11.0d | 0.9c | 4.30e |
| October 25 | 11.2c | 40.0ab | 11.0cd | 12.2bc | 1.1b | 8.90c |
| November05 | 18.5b | 42.4a | 12.7abc | 12.9ab | 1.3a | 13.10b |
| November 15 | 20.2ab | 41.8a | 13.0abc | 12.7ab | 1.4a | 13.8ab |
| November 25 | 22.0a | 40.1ab | 13.7a | 13.1ab | 1.4a | 15.33a |
| December 05 | 21.4a | 41.5ab | 13.3ab | 13.6a | 1.4a | 14.60ab |
| December 15 | 21.3a | 41.2ab | 13.0abc | 12.2bc | 1.4a | 13.50ab |
| December 25 | 20.3ab | 39.5ab | 12.3abc | 11.2cd | 1.2b | 13.20b |
| January 05 | 11.2c | 37.3ab | 9.0d | 8.8e | 0.8c | 6.70d |
| CV (%) | 6.2 | 5.7 | 9.8 | 5.6 | 5.1 | 8.7 |

Means followed by the same letter(s) in a column are not significantly different at 5% level by DMRT

Table 3. Cost and return analysis of Bushbean as influenced by different planting time at OFRD, ARS, BARI, Rangpur during 2002-03

| Planting date | Sell price (Tk./kg) | Gross return (Tk. /ha) | Total variable cost (Tk. /ha) | Benefit cost ratio |
|---|---|---|---|---|
| October 15 | 10.00 | 40300 | 21160 | 1.90 |
| October 25 | 9.50 | 84550 | 21160 | 4.00 |
| November05 | 7.50 | 98250 | 21160 | 4.64 |
| November 15 | 6.50 | 89700 | 21160 | 4.24 |
| November 25 | 6.00 | 91800 | 21160 | 4.35 |
| December 05 | 6.00 | 87600 | 21160 | 4.14 |
| December 15 | 6.50 | 87750 | 21160 | 4.15 |
| December 25 | 6.50 | 85800 | 21160 | 4.05 |
| January 05 | 7.50 | 50250 | 21160 | 2.37 |

# EFFECT OF SOWING TIME ON THE PERFORMANCE OF MUNGBEAN IN AEZ # 3


## Abstract

Three varieties of Mungbean (BARI Mung-2, BARI Mung-2 & BARI 5) were evaluated in different sowing dates (August 30, September 10, September 20 and September 30) at Rangpur during Kharif-II of 2002. Interaction effect of varieties and sowing dates was also significant in respect of grain yield and others characters studied. The variety, BARI Mung-2 produced significantly the highest grain yield (1079 kg/ha) sowing on August 30. The results indicated that among the tested varieties BARI mung-2 was found suitable when sown on August 30.


## Introduction

Mungbean (*Vigna radiata* L. Wilczek) is one of the most important pulse crop in Bangladesh. It is one of the important sources of protein for both man and domestic animals. It has good digestibility and flavour. This crop, like other pulses, has the potential to enrich soil through $N_2$ fixation (B. L .Nag *et al.*, 1998). Mungbean is cultivated in a very limiting area in greater Rangpur region. During kharif-ll, it can be fit in the cropping pattern Wheat-Jute-Mungbean, Potato-Jute-Mungbean and Mustard-Jute-Mungbean in high land where normally T.Aman is not cultivated. But still it is undetermined the optimum sowing time for Mungbean in both two kharif seasons particularly in the AEZ # 3. So, an experiment was undertaken to find out the optimum sowing time for Mungbean cultivation in kharif-ll season.

## Materials and Methods

The experiment was conducted at OFRD, ARS, Rangpur in highland of AEZ #3 during Kharif-II season of 2002-03 in rainfed condition. Three varieties released by Bangladesh Agricultural Research Institute (BARI Mung-2, BARI Mung-4 & BARI Mung-5) were tested sowing on four different dates (August 30, September 20 & September. 30). The experiment was laid out in split plot design with four replications. The varieties were accommodated in main plot and sowing dates assigned in the sub-plot. The unit plot size was 5m x 3m. Seeds were sown maintaining a spacing of 30cm x 10cm. The crop was fertilized with 20-8-10-12-1 kg N-P-K-S-B/ha, respectively. Plant protection measures were taken as and when necessary. Pods were harvested attaining its maturity. Data on the yield and yield attributes were recorded and analyzed. Means separations were done DMRT.

## Results and Discussion

There were appreciable differences in grain yield and yield contributing attributes with the variation of varieties and sowing time (Table 1 & 2).

**Effect of sowing date:** August 30 sowing was significantly the highest seed yields and yield contributing characters. The yield contributing characters were decreased due to late sowing from August 30 sowing (Table 1).

**Effect of Variety:** The varieties significantly influenced the grain yield and yield contributing attributes. BARI Mung-2 gave the significantly highest grain yield (790 kg/ha). The highest grain yield was obtained from BARI Mung-2 due to the highest pods/plant and seeds/pod. Though significantly highest 1000-grain wt. (40.8 gm) was obtained from BARI Mung-5 but this variety produced significantly the lowest pods/plant and seeds/pod (Table 2).

**Interaction between effect of sowing time and variety:** The interaction effect of variety and sowing time showed significant effect on all characters studied (Table 3). BARI Mung-2 sowing on August 30 gave the significantly the highest grain yield (1079 kg/ha) possibly due to the highest number of pods/plant, seeds/pod though 1000-grain wt. was significantly lower than BARI Mung-5. Days to flower and mature decreased due to late sowing from August 30 sowing for all the varieties. Plant height, number of pods/plant, pod length, seeds/pod and 1000 grain wt. were also decreased due to late sowing from August 30 sowing time for all the varieties (Table 3). These results indicated that among the tested varieties BARI mung-2 was found suitable when sown on 30 August sowing at Rangpur region.

On the basis of yield performance of the BARI Mung-2 could be cultivated sowing on 30 August. However, the trial needs repeat next year to validate this year's results.

**References**

Nag, B.L; Talukder M.M.R; Hafizullah , M; Nandey, S.K. and S. Rahman. 1998. Effect of number and time of weeding on the yield and yield attribute of mungbean. Bangladesh J. Agril. Res. 23 (2): 289-298

Table 1. Effect of sowing time on the yield, yield attributes and other characters of mungbean (averaged over varieties) during kharif II season of 2002 at OFRD, ARS, BARI, Rangpur

| Sowing date | Plant height (cm) | Pod length (cm) | Pods/ plant (no.) | Seeds/ pod (no.) | 1000-seed wt. (g) | 80% maturity (DAS) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Aug. 30 | 54.8a | 6.8a | 12.3a | 10.7a | 34.8a | 68a | 917a |
| Sept. 10 | 48.8b | 6.3b | 11.3b | 10.0b | 33.9b | 65b | 754b |
| Sept. 20 | 44.2c | 5.9c | 9.0c | 9.3c | 33.2c | 60c | 556c |
| Sept. 30 | 41.6d | 5.4d | 7.7d | 9.3c | 32.8c | 57d | 439d |
| CV (%) | 2.44 | 3.78 | 11.29 | 7.71 | 1.93 | 2.03 | 7.73 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

Table 2. Performance of mungbean varieties (averaged over sowing dates) during kharif II season of 2002 at OFRD, ARS, BARI, Rangpur

| Variety | Plant height (cm) | Pod length (cm) | Pods/ plant (no.) | Seeds/ pod (no.) | 1000-seed wt. (g) | 80% maturity (DAS) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| BARI mung-2 | 46.9b | 6.0b | 13.3a | 10.3a | 28.8c | 66a | 790a |
| BARI Mung-4 | 54.6a | 5.9b | 9.0b | 10.5a | 31.6b | 62b | 645b |
| BARI Mung-5 | 44.6c | 6.3a | 8.0c | 8.8c | 40.8a | 59c | 565c |
| CV (%) | 2.60 | 4.70 | 8.90 | 10.17 | 2.80 | 2.10 | 8.38 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

Table 3. Interaction effect of variety and sowing time on the yield, yield attributes and other characters of mungbean during kharif II season of 2002 at OFRD, ARS, BARI, Rangpur

| Variety | Sowing date | Plant height (cm) | Pod length (cm) | Pods/ plant (no.) | Seeds/ pod (no.) | 1000-seed wt (g) | 80% maturity (DAS) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|
| BARI mung-2 | August 30 | 58.8a | 6.7b | 16a | 11a | 29.9g | 71a | 1079a |
| | September-10 | 47.6d | 6.2cd | 15a | 10ab | 28.8h | 69b | 872b |
| | September-20 | 41.8f | 6.0de | 12b | 10ab | 28.4h | 64c | 659c |
| | September-30 | 39.2g | 5.3fg | 10cd | 10ab | 28.1h | 60e | 549d |
| BARI mung-4 | August 30 | 60.2a | 6.5bc | 11bc | 11a | 32.3d | 68b | 862b |
| | September-10 | 56.7b | 6.1d | 10cd | 11a | 31.9de | 65c | 732c |
| | September-20 | 51.4c | 5.7e | 8ef | 10ab | 31.1ef | 59e | 548d |
| | September-30 | 49.9c | 5.2g | 7fg | 10ab | 30.9f | 57f | 438e |
| BARI mung-5 | August 30 | 45.3e | 7.1a | 10cd | 10ab | 42.2a | 64c | 812b |
| | September-10 | 42.2f | 6.5bc | 9de | 9bc | 41.2b | 62d | 659c |
| | September-20 | 39.3g | 6.1d | 7fg | 8c | 40.2c | 56f | 460e |
| | September-30 | 35.6h | 5.6ef | 6g | 8c | 39.5c | 54g | 329f |
| CV (%) | | 2.44 | 3.78 | 11.29 | 7.71 | 1.93 | 2.03 | 7.73 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

# DETERMINATION OF SUITABLE PLANTING RANGE FOR GARDEN PEA CULTIVATION


## Abstract

Four varieties of garden pea (BARI Motorshuti-1, BARI Motorshuti-2, BARI Motorshuti-3 and IPSA Motorshuti-1) were tested at the farm of OFRD, ARS, BARI, Rangpur during rabi, 2002-03 planting on different dates from October 22 to January 22 at 15 days interval to select suitable variety (s) and its optimum planting time. The result showed that there were significant differences among the varieties and different planting dates in respect of all the characters studied except seed per pod. The yield performances of the varieties were in order: BARI Motorshuti-3 > BARI Motorshuti-2 > BARI Motorshuti-1 > IPSA Motorshuti-1. BARI Motorshuti-3 produced the higher edible pod yield (17.72 t/ha) when sown on 22 November which was statistically identical to December sowing of same variety.


## Introduction

Garden pea is a popular vegetable all over Bangladesh during winter season. For last few years the area and yield of this crop is reducing day by day. The reduction of area is probably due to low yield of existing variety; seeds are sown not in proper time, unfavorable weather during growth period etc. Recently BARI and IPSA has developed a few new varieties viz. BARI Motorshuti-1, BARI Motorshuti-2, BARI Motorshuti-3 and IPSA Motorshuti-1 respectively. Higher yield of those varieties might attract the attention to the farmers. But it is still unknown in the Rangpur region that which variety is better at which sowing time. The proper combination of a variety with its sowing time will be able to boost up the yield and escape different hazards. So, keeping this view in mind a trial was conducted to select suitable variety(s) and to determine its proper planting range for garden pea cultivation in Rangpur region.

## Materials and Methods

The experiment was conducted at the farm of On-Farm Research Division, ARS, BARI, Rangpur during rabi season of 2002-03 in highland of sandy loam soil under AEZ # 3. The four varieties of garden pea ($V_1$: BARI Motorshuti-1, $V_2$: BARI Motorshuti-2, $V_3$: BARI Motorshuti-3 and $V_4$: IPSA Motorshuti-1 were tested planting on seven different dates ($D_1$: October 22, $D_2$: November 07, $D_3$: November 22, $D_4$: December 07, $D_5$: December 22, $D_6$: January 07 and $D_7$: January 22). The experiment was laid out in a split plot design with 3 replications. The planting dates were accommodated in the main plots and the varieties were assigned in the sub plots. The unit plot size was 3 m X 3 m. Seeds of BARI Motorshuti-1, BARI Motorshuti-2 and IPSA Motorshuti-1 were sown maintaining the spacing of 60 cm x 15 cm and that of BARI Motorshuti-3 with 30 cm x 10 cm. The plot of each planting dates were prepared properly and fertilized at the rate of 70-30-50-20-4-1-10000 kg N P K S Zn B and cowdung per hectare. The source of N, P, K, S, S, Zn and B was urea, TSP, MP, gypsum, -zinc sulphate and borax. The entire quantity of cow dung, TSP, gypsum, zinc sulphate and borax and half of urea and MP were t applied as basal during the final plot preparation. The rest of urea and MP were applied as top dress at 20 and 30 days after sowing (DAS). Irrigation and other intercultural operations and plant protection measures were taken as and when necessary. The green pod was harvested from each plantings of each variety at the time for edible. Data on the yield and yield attributes were recorded and analyzed statistically and mean separation was done by DMRT.

## Results and Discussion

Results of the effects of planting time averaged over varieties, performance of the varieties and the interaction effects between planting dates and varieties have been presented in table, 2 and 3 respectively.

**Effect of planting date:** The edible pod yield, yield attributes and other characters studied were differed statistically except seed per pod. Significantly the highest edible pod yield (12.57 t/ha) was recorded from November 22 planting. The obtained higher and lower yields were mainly due to higher and lower plant population and pods per plant, respectively. Excess moisture in early planting due to rainfall (100 mm) in October 2002 ensured to damage seedlings affected by foot rot disease and low temperature (Maximum $19^0$C and Minimum $9^0$C) in January 2003 hampered germination for which plant population reduced in October and January plantings.

**Effect of varieties:** Different varieties showed significant difference in respect of yield and yield attributes except seed per pod. Among the four varieties, BARI Motorshuti-3 produced significantly the highest edible pod yield (9.60 t/ha). The lowest yield (4.15 t/ha) was obtained from IPSA Motorshuti-1. However, the yield performances of the tested varieties were in order: BARI Motorshuti-3 > BARI Motorshuti-2 > BARI Motorshuti-1> IPSA Motorshuti-1. The lower yields obtained from the varieties were mainly due to the lower plant population and less pod per plant.

**Interaction effects of planting date and variety:** There was significant effect between planting dates and varieties on all the characters studied except seed per pod. BARI Motorshuti-3 produced significantly the highest edible pod yield of 17.72 t/ha in November 22 planting which was statistically identical to 7 December planting. Before and after this planting date the yield was significantly decreased. The higher yields of variety x planting date were mainly due to higher plant population and higher pod weight. These results indicated that planting range from 22 November to 7 December was found as the optimum for BARI motor shuti-3 and .BARI motor shuti-1

## Conclusion

On the basis of yield performance of all the tested varieties, BARI Motorshuti-3 and BARI Motorshuti-2 could be cultivated planting from 22 November to 7 December, respectively. However, the trial needs repeat next year to validate this year's results.

Table 1. Effect of planting on the yield, yield attributes and other characters of garden pea during rabi-2002-03 at OFRD, ARS, BARI, Rangpur

| Planting date | Plant height (cm) | wt of pods per plant (g) | Plant per $m^2$ (No.) | Pods per plant (No.) | Seeds per pod (No.) | Harvesting (DAS) | Marketable pod yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Oct 22 | 54.03d | 22.84c | 16.58cd | 13.25d | 4.50 | 79.83b | 5.78d |
| Nov 07 | 62.12b | 25.97b | 17.92b | 19.90b | 4.67 | 85.25a | 7.82c |
| Nov 22 | 65.22a | 27.20ab | 20.08a | 25.20a | 5.25 | 84.00a | 12.57a |
| Dec 07 | 57.20c | 28.18a | 19.33a | 19.32b | 5.33 | 77.50b | 9.58b |
| Dec 22 | 50.07e | 21.78cd | 17.58bc | 15.70c | 4.67 | 72.00c | 4.67e |
| Jan 07 | 41.53f | 20.05d | 15.67d | 9.57e | 4.67 | 71.17c | 2.87f |
| Jan 22 | 41.09f | 14.12e | 11.00e | 5.67f | 4.83 | 79.25b | 1.50g |
| CV (%) | 4.2 | 9.6 | 10.0 | 8.0 | 10.1 | 4.7 | 8.7 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

Table 2. Effect of the varieties of garden pea during rabi-2002-03 at OFRD, ARS, BARI, Rangpur

| Planting date | Plant height (cm) | wt of pods per plant (g) | Plant per $m^2$ (No.) | Pods per plant (no.) | Seeds per pod (no.) | Harvesting (DAS) | Marketable pod yield (t/ha) |
|---|---|---|---|---|---|---|---|
| BGP-1 | 69.62b | 19.80c | 13.52c | 11.57b | 5.00 | 98.52a | 6.10c |
| BGP-2 | 78.55a | 22.27b | 15.00b | 12.00a | 4.76 | 95.67b | 6.64b |
| BGP-3 | 41.95c | 31.72a | 25.43a | 9.43c | 4.86 | 56.71c | 9.60a |
| IPSA-1 | 22.06d | 15.57d | 13.57c | 6.90d | 4.76 | 57.01c | 4.15d |
| CV (%) | 5.78 | 10.03 | 9.50 | 6.37 | 12.57 | 5.48 | 9.14 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

Table 3. Interaction effect of planting dates and varieties on the yield, yield attributes and other characters of garden pea during rabi-2002-03 at OFRD, ARS, BARI, Rangpur

| Planting date x Variety | Plant height (cm) | Pods/ plant (no.) | Seed /pod (no.) | wt of pods per plant (g) | Plant per $m^2$ (no.) | Harvesting (DAS) | Marketable pod yield (t/ha) |
|---|---|---|---|---|---|---|---|
| $D_1V_I$ | 82.2cd | 34.0d | 4.67 | 21.00h-k | 13.3h-j | 110a | 5.06hij |
| $D_1V_2$ | 85.9bc | 9.3jk | 4.67 | 20.00i-k | 15.3f-h | 95b | 5.67fi |
| $D_1V_3$ | 29.7l | 5.0l-o | 4.33 | 31.30cd | 27.0b | 55d | 8.92e |
| $D_1V_4$ | 18.4n | 4.7l-o | 4.33 | 19.60i-k | 12.0j-l | 56d | 2.93lm |
| $D_2V_I$ | 88.8b | 45.0b | 4.67 | 25.00e-h | 13.0i-k | 114a | 6.77f |
| $D_2V_2$ | 99.7a | 8.0ki | 4.67 | 20.80g-k | 14.0g-j | 114a | 6.20fg |
| $D_2V_3$ | 35.6k | 11.6ij | 4.67 | 35.75b | 28.3ab | 56d | 13.13c |
| $D_2V_4$ | 24.3m | 5.0l-o | 4.67 | 22.30f-j | 15.0f-I | 57d | 5.70f-i |
| $D_3V_I$ | 83.9bc | 57.0a | 6.33 | 26.57ef | 15.3f-h | 111a | 11.67d |
| $D_3V_2$ | 103.3a | 21.0e | 4.67 | 23.23f-j | 17.3de | 111a | 14.97b |
| $D_3V_3$ | 52.5fg | 15.7gh | 5.33 | 40.67a | 29.7a | 57d | 17.72a |
| $D_3V_4$ | 21.2mn | 10.7j | 4.67 | 24.10e-i | 18.0d | 57d | 5.94f-h |
| $D_4V_I$ | 74.40e | 37.0c | 4.67 | 23.60f-j | 15.0f-I | 97b | 10.70d |
| $D_4V_2$ | 81.6cd | 14.0hi | 5.33 | 20.00i-k | 16.3d-f | 98b | 11.70d |
| $D_4V_3$ | 47.9g-i | 12.1ij | 5.67 | 34.87bc | 30.0a | 57d | 17.25a |
| $D_4V_4$ | 24.9lm | 10.6j | 5.67 | 28.40de | 16.0e-g | 58d | 4.78ij |
| $D_5V_I$ | 56.5f | 33.0d | 4.67 | 25.37e-g | 14.0g-j | 87c | 4.17jk |
| $D_5V_2$ | 77.1de | 11.3j | 4.67 | 26.60ef | 15.0f-I | 87c | 3.97j-l |
| $D_5V_3$ | 42.7ij | 11.1j | 4.67 | 28.00de | 28.3ab | 57d | 5.59gi |
| $D_5V_4$ | 24.0mn | 7.4kl | 4.67 | 21.47g-j | 13.0i-k | 57d | 3.98kl |
| $D_6V_I$ | 53.5fg | 19.0ef | 4.67 | 20.50h-k | 13.0i-k | 87c | 2.67m |
| $D_6V_2$ | 53.4fg | 6.6lm | 4.67 | 16.60kl | 15.0f-I | 87c | 3.65mn |
| $D_6V_3$ | 38.5jk | 6.0l-n | 4.67 | 21.60g-j | 23.7c | 57d | 2.83 m |
| $D_6V_4$ | 20.7mn | 6.7l-n | 4.67 | 16.50kl | 11.0k-m | 57d | 3.32km |
| $D_7V_I$ | 48.1ghi | 12.0ij | 5.33 | 14.30lm | 11.0k-m | 81c | 1.65no |
| $D_7V_2$ | 48.9gh | 3.0o | 4.67 | 11.80m | 12.0j-l | 80c | 1.30o |
| $D_7V_3$ | 46.3hi | 4.4m-o | 4.67 | 19.17jk | 11.0k-m | 58d | 1.68no |
| $D_7V_4$ | 21.0mn | 3.4no | 4.67 | 11.5m | 10.0m | 56d | 1.350 |
| CV (%) | 5.78 | 6.37 | 12.50 | 10.30 | 9.50 | 5.48 | 9.14 |

Means in a column followed by the same letter(s) are not significantly different at the 5 % level by DMRT

# PERFORMANCE OF MANAGEMENT PRACTICES ON THE YIELD OF SESAME UNDER OLD BRAHMAPUTTRA FLOODPLAIN SOILS OF AEZ 9


## Abstract

Package of management practices viz. sowing without post care; one hand weeding at 20 days after sowing; and fertilizer application along with one hand weeding at 20 days after sowing for higher yield of sesame (T-6) was conducted at farmers' field during the Kharif-1 season of 2001 & 2002. On an average, result revealed that the highest seed yield was obtained where fertilizer was applied along with one hand weeding at 20 days after sowing (980 kg/ha) which was equivalent to 131% higher yield compared to sowing without post care. The lowest seed yield was obtained from sowing without post care (465 kg/ha) whereas yield of one hand weeding at 20 days after sowing was also nominal (595 kg/ha).


## Introduction

Sesame (*Sesamum indicum*) is the second largest sources of edible oil in Bangladesh. The yield of sesame is very low due to poor management practices under field condition such as improper use of fertilizer, seeds, poor weed control etc. Proper package of improve management practices can increase the productivity of sesame up to a considerable extent (Mukherji, 1982). However, findings like improve package of production practices based on agro-ecological zones at farmers' field is meagre in the country. Hence, the present study was undertaken at the Farming Systems Research and Development Site, Narikeli, Jamalpur during the Kharif-1 season of 2001 to determine the package of improve management practices for higher yield of sesame under Old Brahmaputtra floodplain soils of AEZ 9.

## Materials and Methods

The experiment was conducted at FSRD, Site, Narikeli, Jamalpur during the Kharif-1 season of 2001 & 2002 to determine the package of improve management practices for higher yield of sesame under AEZ 9. The experimental area was rainfed medium highland of clay loam soil having the $p^H$ value of 5.9. The treatment include in study were i) sowing without post care; ii) one hand weeding at 20 days after sowing (DAS) and iii) fertilizer and one hand weeding at 20 DAS. The variety used was T-6 and the seed rate was 6 kg/ha. The experiment was conducted in a randomized complete block design with six dispersed replication. The unit plot size was 3m x 5m. The land was fertilized was 60 kg N, 55 kg $P_2O_5$ and 40 kg $K_2O$ per hectare through urea, Triple super phosphate and muriate of potash. The entire amount of fertilizer was applied at the time of final land preparation. The seeds were broadcasted on March 19-April 4, 2001 and March 19-24, 2002 and the crops were harvested from June 7-11, 2001 and June 18-22, 2002. The data on the yield attributes were collected from 10 randomly selected plants collected prior to harvest from each plots. The collected data were analyzed statistically and means were separated with DMRT test.

## Results and Discussion

All the characters except plants/$m^2$ and 1000-seed weight differed significantly due to variation in management practices (Table 1). The highest plant height was obtained from treatment $T_3$ which was statistically at par $T_2$ and the lowest height from $T_1$. Similar trend was followed in case of plant/$m^2$, branches/plant, capsule/plant and seeds/capsule. All the characters showed the lowest in sowing without post care. Significantly the highest seed yield was obtained from fertilizer with one hand weeding at 20 DAS which might be due to higher branches/plant, capsule/plant, seed/capsule. It is revealed that 94% increase yield was achieved with fertilizers and weeding. Only one hand weeding also showed 27% higher yield than without post sowing care. This treatment showed the lowest yield among the treatments. The result might appear due to competition between weeds and crops for moisture and nutrients resulting in significant reduction in yield components. Similar results were also reported by Gaur and Trehan (1974). Jain *et al*. (1985) opined that weeds offered a serious competition to sesame plants and caused a reduction in yield to the extent of 46% to 76% which was more or less concurrent with the present findings (29%). However, from the result it may be concluded that higher yield could be obtained when fertilizer was applied along with one hand weeding at 20 days after sowing which was equivalent to 131% higher yield compared to sowing without post care.

**References**

Gaur, B.L. and K.B. Trehan. 1984. Effect of spacing and fertilization on the rainfed sesame (*Sesamum indicum)*. Indian J. Agron. 19(3):217-219.

Jain, G.L., S.M. Singh., M.P. Sahu and G.K. Sharma. 1985. Sesame production in Rajastan. Oilseed production. Constrains and Opportunities, New Delhi. pp. 181-198.

Table 1. Yield and yield contributing characters of sesame influenced by different management practices at Narikeli, Jamalpur during 2002-03

| Treatment | Plant height (cm) | Plants/m$^2$ | Branches/ plant | Capsule/ plant | Seeds/ capsule | 1000-seed weight (g) | Seed yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2001-02 | 2002-03 |
| $T_1$ | 73.5b | 46.7b | 2.20b | 26.0c | 37.5c | 3.20 | 417c | 514c |
| $T_2$ | 90.2a | 56.0ab | 2.37b | 36.0b | 47.2b | 3.22 | 537b | 654b |
| $T_3$ | 102.3a | 64.0a | 3.35a | 51.7a | 56.0a | 3.25 | 969a | 997a |
| F-test | ** | ** | ** | * | * | NS | ** | * |
| CV (%) | 9.60 | 12.61 | 6.16 | 9.08 | 11.23 | 5.96 | 10.90 | 10.26 |

Figures in a column having similar letter do not differ significantly by DMRT.

$T_1$= Sowing without post care
$T_2$= On hand weeding at 20 DAS and
$T_3$= Fertilizer and one hand weeding at 20 DAS

# ON-FARM PERFORMANCE OF PROMISING SWEET POTATO VARIETY DEVELOPED BY BARI


## Abstract

On-farm performance of sweet potato viz. Tripti, BARI Sweet Potato-4, BARI Sweet Potato-5, Kamalasunduri and Daulatpuri were evaluated against the farmers' local variety at multiplication test site of Melandah, Jhenaidah & Magura (Jessore) during the rabi season of 2001-2002. The result from Melandah showed that Tripti gave the highest tuber yield 25.0 t/ha. On the contrary, the performance of local variety was very poor which yielded only 13.9 t/ha. The highest gross return and benefit cost ratio was obtained from variety Tripti. At Comilla, the highest yield and gross return was obtained from variety Tripti. But variety Tripti was not included in the study at Jessore so Kamalasunduri gave the highest yield at Kamalasunduri at Magura but Kamalasunduri and BARI SP-4 same yield at Jhenaidah. At Faridpur, similar yield was obtained from Daulatpuri BARI SP-4 & BARI SP-5. At Lebukhali, Patuakhali all the variety performed better except Kamalasunduri which produced the lowest yield among the varieties.


## Introduction

Sweet potato a carbohydrate rich root crop can be used as a substitute of cereals in Bangladesh to meet up the food shortage. Generally, poor people are the consumers of sweet potato. It is the main source of carbohydrate and carotene for their survival. Farmers are using local variety, which is low yielded, and contain less carotene. Bangladesh Agricultural Research Institute (BARI) has developed two sweet potato varieties viz. BARI sweet potato-4 (SP-4) and BARI sweet potato -5 (SP-5) which has high yield ability and also contain high amount of carotene. These varieties need on-farm trial to evaluate their performance and also to get feed back from the farmers. Keeping the views in mind the experiment was under taken to evaluate their performance of recently developed sweet potato varieties developed by BARI.

## Materials and Methods

The on farm validation trial of sweet potato were conducted at MLT site, Melandah, Magura and Jhenaidah during rabi season of 2001-02. Three varieties viz. Tripti, Sp-4, SP-5, Kamalasunduri, Daulatpuri and the local were tested in the farmers' field of Melandah. The vine was planted at the spacing 60 cm x 30 cm. The plot size was 6m x 9m per variety at each farmer's field. The crop was fertilized with 40-20-50-7-1.5 kg N-P-K-S-Zn/ha respectively. Half of urea & all others fertilizer were used at final land preparation. Remaining part of N fertilizer was top dressed in two equal splits 15 & 35 DAT. The vines were planted on December 18, 2002 at Melandah, 5 December 2002 at Magura and Jhenaidah. One weeding was done during the period of 15-30 DAT. There was no incidence of disease and pest attack. The crop was harvested during 27 April, 2003 at Melandah, 1$^{st}$ week of May 2003 at Magura and Jhenaidah.

## Results and Discussion

**Site: Melandah**

The results showed that the maturity period of them ranges 122-130 days. Variety was significantly affected the tuber yield of sweet potato (Table 1). The highest tuber yield (24.71 t/ha) was obtained from BARI SP-4, which was statistically similar to BARI SP-5. Local variety gave the lowest tuber yield. The highest gross return and BCR was recorded from variety BARI SP-4 followed by BARI SP-4.

**Site: Magura and Jhenaidah**

At Magura, the highest yield was obtained from variety BARI SP-4 due to higher no. of tubers/plant and weight of tubers/plant (Table 1). At Jhenaidah, same variety (BARI SP-4) showed the highest yield due to higher weight of tubers.

**Farmers' reaction**

Farmers of Melandah opined that after boiling both the new varieties became very soft so farmers do not like. Moreover, local variety had better keeping quality than the released varieties when preserved under normal condition. These new varieties may harvest few days earlier than the local which sale is higher price. The local people prefer the yellow color of BARI SP-5 but at Jessore area local farmers are not prefers the BARI variety due to its less taste.

Table 1. Effect of different varieties on yield and yield components of sweet potato at Melandah, Jamalpur during 2002-03

| Variety | Branches /plant (no.) | Leaves/ plant (no.) | Vines wt./ plant | Tuber/ plant (no.) | Tuber wt./plant (kg) | Tuber length (cm) | Breadth of tuber (cm) | Boiling duration (Min.) |
|---|---|---|---|---|---|---|---|---|
| BARI SP-4 | 7.40c | 101d | 258b | 4.20a | 446.00a | 12.90ab | 15.0ab | 30c |
| BARI SP-5 | 14.30b | 131c | 384a | 3.95a | 489.50a | 13.50a | 16.0a | 40b |
| Daulatpuri | 9.50c | 223a | 292b | 3.15ab | 285.56b | 12.00b | 14.5b | 42a |
| Local | 17.40a | 174b | 260b | 2.60b | 230.50b | 10.50c | 12.3c | 40b |
| CV (%) | 10.68 | 11.09 | 9.09 | 10.89 | 6.76 | 9.04 | 7.25 | 6.51 |

Figure in a column having similar letters do not differ significantly by DMRT.

Table 2. Economic performance of sweet potato varieties developed by BARI at MLT Site, Melandah during 2001-02 & 2002-03

| Variety | Tuber yield (t/ha) | | Gross return (Tk./ha) | | Variable cost (Tk./ha) | BCR | |
|---|---|---|---|---|---|---|---|
| | 01-02 | 02-03 | 2001-02 | 2002-03 | | 2001-02 | 2002-03 |
| BARI SP-4 | 21.0a | 24.71a | 36750 | 49420 | 13162 | 2.79 | 3.75 |
| BARI SP-5 | 16.1b | 23.90a | 28175 | 47800 | 13162 | 2.14 | 3.63 |
| Daulatpuri | 15.5b | 13.15b | 34875 | 49025 | 13162 | 2.65 | 3.50 |
| Local | 13.9b | 11.18c | 34750 | 39130 | 13162 | 2.64 | 2.57 |
| CV (%) | | 10.92 | | | | | |

**Price (Tk/kg):** Tripti, BARI SP-4, BARI SP-5, Kamalasunduri Tk. 1.75/-, Daulatpuri & local Tk. 2.25/-

Table 3. Mean performance of sweet potato (MLT site Magura and Jhenaidah, Jessore during 2002-03

| Location | Variety | No. of tuber/plant | Weight of tubers/plant (kg) | Tuber yield (t/ha) | |
|---|---|---|---|---|---|
| | | | | 2001-02 | 2002-03 |
| Magura | BARI SP-4 | 5a | 0.88a | 18.17 | 36.08a |
| | BARI SP-5 | 4b | 0.73b | 19.33 | 31.00b |
| | Local | 4b | 0.34c | 12.17 | 14.83c |
| Jhenaidah | BARI SP-4 | 4a | 0.61a | 37.74 | 29.95a |
| | BARI SP-5 | 4a | 0.43b | 36.20 | 26.53b |
| | Local | 3b | 0.25c | 29.12 | 11.66c |

# EFFECTS OF SEED CORMEL SIZE AND PLANT SPACING ON THE YIELD OF MUKHIKACHU


## Abstract

An experiment was conducted at RARS, Jamalpur during kharif-1 season of 2001 & 2002 to find out the cormel seed size with optimum spacing for higher yield of Mukhikachu. The result showed that the highest cormel yield (28.08 t/ha) was obtained from cormel seed size (small 20±5g) with closer spacing 60 cm x15 cm. This treatment also showed higher gross return than other treatments.


## Introduction

Mukhikachu *(Colocasia esulenta* L. Schott.) is a popular indigenous vegetable of Bangladesh. The crop is extensively grown in the summer season, and is considered as an important vegetable, particularly in the months of September, October and November when the supply of other vegetables is scarce in the market. But till now, there has been no proper management on the production of this crop in Bangladesh. It is well documented that seed size and plant spacing have significant influence on the growth and yield of different crops and it is like that both the factors have similar effects on the yield of Mukhikachu. The present investigation was, therefore, undertaken with a view to find out the optimum size of seed cormel, proper plant spacing and method of planting for the production of Mukhikachu.

## Materials and Methods

The experiment was conducted at RARS, Jamalpur, in Kharif season of 2001 & 2002. The treatment consisted of 3 levels of seed cormel size (small, medium and large weighing 20±5 g, 30±5 g and 40±5g per seed, respectively), and 4 levels of plant spacing (60 cm x 15 cm, 60 cm x 30 cm, 60 cm x 45 cm and 60 cm x 60 cm). The experiment was set up in a factorial randomized complete block design with 3 replications. Seed cormels of Mukhikachu variety Bilashi were planted on 26February, 2001 and 11 February, 2002. The unit plot size was 6 m x 1.8 m. The crop received 10 tons cowdung, 140 kg urea, 100 kg triple super phosphate and 120 kg muriate of potash per hectare. Cowdung and triple super phosphate were applied during land preparation. Urea and muriate of potash were side dressed in two equal splits 40 and 90 days after planting. The crop was harvested on 3 November, 2001, (248 days after planting) and 24 October, 2002 (255 DAP).

## Results and Discussion

### Effect of cormel size

The results pertaining to the yield and yield contributing characters due to cormel size has been presented in Table 1. It indicated that plant height increased significantly with the increase of cormel size. The highest plant height was recorded when large size cormel was planted while it was shortest with smaller size cormel. The similar trend was also noticed in case of leaves/plant. But the reverse observation was found in number of hill/sucker. The highest number of sucker was found in small sized cormel while it was significantly the lowest in large size cormel. But the number of cormel/hill was statistically similar in both small and large size cormel. The medium size cormel produced significantly lower number of cormel/hill. The weight of cormel/hill was found the highest in small size cormel and decreased significantly with the larger size. The similar trend was also observed in yield of cormel also. However, significantly the highest yield was recorded in small size cormel while it was the lowest in large size cormel. Similar trend was obtained during 2001.

### Effect of spacing

The result indicated that the plant height increased significantly with the increase in spacing (Table 1). The shortest plant was recorded with the closer spacing while it was the highest in larger spacing. The similar trend was also observed in case of number of leaves/plant. But the no. of suckers/hill was the highest in closer spacing and decreased significantly with larger spacing. Similar trend was observed in case of no. of cormel/hill and weight of cormel/hill also. However, significantly the highest cormel yield was observed in closer spacing (18.79 t/ha) while it was the lowest in larger spacing. Some trend was followed in 2002.

**Interaction effect**

All the yield and yield contributing characters except no. of leaves/plant and sucker/plant were significant due to cormel size and spacing (Table 2). There was trend to increase plant height with the increase of cormel size and spacing. Similar trend was followed in case of leaves/plant but significantly the highest suckers/hill was recorded from wider spacing of large size cormel. Cormel/hill showed higher in medium size. Cormel with 60 cm x 60 cm followed by 60 cm x 15 cm and the lowest from wider spacing with large size. Significantly the highest wt. of cormels/hill was obtained from closer spacing of small size cormel. Similar trend was followed in case of cormel yield in both the years.

**Cost and return analysis**

Seed cormel when used in smaller size with closer spacing required 13320 Tk/ha (Table 3) and the amount decreased gradually with the wider spacing. The same trend was exhibited in medium and large size. But the gross return was found the highest in closer spacing with small size cormel (95960 Tk/ha). Form one-year result showed the highest yield and gross return of Mukhikachu could be achieved by small cormel size (20±55) with spacing 60 cm x 15 cm.

Table 1. Yield and yield contributing characters of Mukhikachu (cv. Bilashi) as affected by cormel size and spacing

| Treatment | Plant height (cm) | Leaves/ plant (no.) | Suckers/ hill (no.) | Cormel/ hill (no.) | Cormel wt. /hill (g) | Yield (t/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2002-03 | 2001-02 |
| **Cormel size** | | | | | | | |
| Small (20±5 g ) | 80.75c | 4.11c | 8.08a | 13.75a | 681.67a | 15.56a | 18.25a |
| Medium(30±5 g) | 146.42b | 4.86b | 6.92b | 11.75b | 575.00b | 14.38b | 17.98b |
| Large (40±5 g ) | 166.17a | 5.28a | 6.17c | 13.42a | 526.67c | 13.13c | 17.28c |
| F-test | ** | ** | ** | ** | ** | * | ** |
| **Spacing** | | | | | | | |
| 60 cm x 15 cm | 102.56c | 3.97c | 8.56a | 13.33a | 665.56a | 18.79a | 22.63a |
| 60 cm x 30 cm | 128.33b | 4.24b | 6.44c | 13.67a | 595.56c | 15.70b | 19.85b |
| 60 cm x 45 cm | 144.67a | 5.12a | 7.67b | 12.44b | 611.11b | 11.38c | 14.81c |
| 60 cm x 60 cm | 148.89a | 5.67a | 5.56d | 10.44c | 505.56d | 11.54c | 14.04d |
| F-test | ** | ** | ** | ** | ** | ** | ** |
| CV (%) | 9.48 | 8.59 | 10.11 | 9.84 | 12.96 | 11.35 | 10.01 |

Figure in the column having similar letter do not differed significantly by DMRT.

Table 2. Interaction effects of cormel size and plant spacing on the yield & yield components of Mukhikachu (cv. Bilashi)

| Interaction | | Plant height (cm) | Leaves/ plant (no.) | Suckers/ hill (no.) | Cormel/ hill (no.) | Wt. of cormels/ hill (g) | Yield of cormel ($t\ ha^{-1}$) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2002-03 | 2001-02 |
| Small | 60 cm x 15 cm | 59.67g | 3.00g | 4.33f | 15.67a | 760.00a | 23.99 a | 28.08a |
| | 60 cm x 30 cm | 87.33f | 4.07f | 6.00e | 11.00e | 526.67ef | 12.75ef | 16.66f |
| | 60 cm x 45 cm | 89.00f | 4.30f | 7.00d | 12.67d | 546.67e | 10.22g | 14.81h |
| | 60 cm x 60 cm | 87.00f | 4.87f | 7.33d | 14.33b | 616.67c | 10.54g | 13.43J |
| Medium | 60 cm x 15 cm | 115.67e | 4.03e | 6.00e | 11.33e | 523.33f | 16.99c | 20.37c |
| | 60 cm x 30 cm | 138.00d | 4.47d | 6.33e | 13.33bcd | 573.33d | 22.34b | 24.07b |
| | 60 cm x 45 cm | 158.00c | 5.13c | 7.33d | 14.33b | 583.33d | 12.09f | 14.20I |
| | 60 cm x 60 cm | 174.00b | 5.80b | 8.00c | 16.00a | 620.00c | 13.29e | 13.27k |
| Large | 60 cm x 15 cm | 132.00d | 4.67d | 6.33e | 11.00e | 576.67d | 15.39d | 19.44d |
| | 60 cm x 30 cm | 159.67c | 4.20c | 7.00d | 13.00cd | 686.67b | 12.00f | 18.83e |
| | 60 cm x 45 cm | 187.00a | 5.93a | 8.67b | 14.00bc | 703.33b | 11.84f | 15.43g |
| | 60 cm x 60 cm | 185.67a | 6.33a | 10.33a | 9.00f | 416.67g | 10.79g | 15.43g |
| F-test | | ** | NS | NS | ** | ** | ** | ** |
| CV (%) | | 9.47 | 12.59 | 10.11 | 9.84 | 8.96 | 10.35 | 10.01 |

Figure in the column having similar letter do not differed significantly by DMRT

Table 3. Investment due to seed cormels and return/ha as influenced by seed size and plant spacing in Mukhikachu (cv. Bilashi)

| Spacing (cm) | Seed cormel size (g/seed) | | | | | |
|---|---|---|---|---|---|---|
| | Small (20±5 g ) | | Medium (30±5 g ) | | Large (40±5 g) | |
| | Seed cormels required ($kg\ ha^{-1}$) | | | | | |
| 60 x 15 | 2220 | | 3332 | | 4440 | |
| 60 x 30 | 1110 | | 1666 | | 2220 | |
| 60 x 45 | 740 | | 1110 | | 1480 | |
| 60 x 60 | 550 | | 833 | | 1108 | |
| | Cost of seed cormels ($Tk\ ha^{-1}$) | | | | | |
| 60 x 15 | 13320 | | 19992 | | 26640 | |
| 60 x 30 | 6660 | | 9996 | | 13320 | |
| 60 x 45 | 4440 | | 6660 | | 8880 | |
| 60 x 60 | 3324 | | 4998 | | 6648 | |
| | Gross return from harvested cormels ($Tk\ ha^{-1}$) | | | | | |
| | 2002-03 | 2001-02 | 2002-03 | 2001-02 | 2002-03 | 2001-02 |
| 60 x 15 | 95960 | 112320 | 67960 | 81480 | 61560 | 77760 |
| 60 x 30 | 51000 | 66640 | 89360 | 96280 | 48000 | 75320 |
| 60 x 45 | 40880 | 59240 | 48360 | 56800 | 47360 | 61720 |
| 60 x 60 | 42160 | 53720 | 43160 | 53080 | 53160 | 61720 |

Price (Tk./ha): Seed cormels = 6.00
Harvested cormels= 4.00

# EFFECT OF VARIETY AND PLANT SPACING ON YIELD OF MUKHIKACHU


## Abstract

An investigation was conducted at the Multilocation Test Site, Melandah during the Kharif season of 2002. The result showed that closest spacing (60 cm x 30 cm) with variety Bilashi gave higher yield and gross margin as compared to other treatments. Significantly higher yield was obtained with Bilashi than local one.


## Introduction

Mukhikachu *(Colocasia esculenta* L. Schott.) is a popular indigenous vegetable in Bangladesh. The crop is extensively grown in the summer season and is considered as an important vegetable, particularly in the months of September, October and November when the supply of other vegetables is scarce in the market. But till now, there has been no proper management on the production of this crop. The present investigation was, therefore, undertaken with a view to find out a suitable variety with proper plant spacing for the production of Mukhikachu at Multilocation Test Site, Melandah.

## Materials and Methods

The experiment was conducted at the Multilocation Test Site, Melandah during the Kharif season of 2002. The treatment of the experiment consisted of 2 varieties (Bilashi and Local), and 3 levels of plant spacing (60 cm x 30 cm, 60 cm x 40 cm and 60 cm x 50 cm). The experiment was set in a split plot design where the variety was assigned in the main plot and spacing in the sub plot. The experiment was replicated in three dispersed farmers' field. Seed cormels of 20±5 g was planted on March 19, 2002. The unit plot size was 6 m x 3 m. The crop received 10 tons cowdung, 140 kg urea, 100 kg triple super phosphate and 120 kg muriate of potash per hectare. Cowdung and triple super phosphate were applied during land preparation. Urea and muriate of potash were side dressed in two equal splits 40 and 90 days after planting. Finally the crop was harvested from October 10, 2002.

## Results and Discussion

**Effect of variety:** The results pertaining to the yield and yield contributing characters due to variety has been presented in Table 1. It indicated that plant height, yield and all the yield contributing characters differed significantly due to variety which resulted the highest yield from variety Bilashi.

**Effect of spacing:** The result indicated that plant height, yield and yield contributing characters decreased significantly with the increase in plant spacing. The highest cormel yield was recorded with closest spacing (60 cm x 20 cm) due to higher yield attributes.

.

**Interaction effect:** Plant height, yield and yield attributes were significantly influenced by variety and spacing. The highest plant height was recorded from local variety of 60 cm x 30 cm spacing which was at par to 60 cm x 40 cm of same variety. Significantly the highest leaves/plant was obtained from closer spacing (60 cm x 30 cm) with local variety. The highest cormel/hill was produced from 60 cm x 30 cm spacing of Bilashi variety. Similar trend was followed in case of cormel weight and cormel yield.

Cost and return analysis indicated that closer spacing required higher amount of seed cormel which also required higher amount of seed cost. But in terms of gross return and gross margin was achieved form closer spacing (60 cm x 30 cm).

Table 1. Yield and yield contributing characters of Mukhikachu as affected by variety and spacing

| Treatment | Plant height (cm) | Leaves/ plant | Suckers/ hill | Cormel/hill (no.) | Cormel wt. /hill (g) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| **Variety** | | | | | | |
| Local | 127a | 4.28a | 5.29 | 20.23b | 519.35b | 25.37b |
| Bilashi | 104b | 4.18b | 5.23 | 32.63a | 686.53a | 42.17a |
| F-test | * | * | NS | * | * | * |
| CV (%) | | | | | | |
| **Spacing** | | | | | | |
| 60 cm x 30 cm | 122.40a | 4.95a | 6.55a | 33.85a | 726.68a | 40.31a |
| 60 cm x 40 cm | 116.55b | 4.25b | 5.41b | 25.20b | 681.86b | 35.60b |
| 60 cm x 50 cm | 108.65c | 3.50c | 4.28c | 25.25c | 655.50c | 25.42c |
| F-test | ** | ** | ** | ** | ** | ** |
| CV (%) | 12.23 | 8.36 | 8.56 | 10.60 | 9.38 | 11.87 |

Figure in the column having similar letter do not differed significantly by DMRT.

Table 2. Interaction effects of cormel size and plant spacing on the yield components of Mukhikachu

| Interaction | | Plant ht. (cm) | Leaves/ plant (no.) | Suckers/ hill (no.) | Cormel/ hill (no.) | Cormel wt. /hill (g) | Cormel yield (t/ ha) |
|---|---|---|---|---|---|---|---|
| Local | 60 cm x 30 cm | 130.80a | 5.15a | 6.91 | 24.10c | 562.10d | 19.40e |
| | 60 cm x 40 cm | 127.90a | 4.25e | 6.00 | 20.75d | 504.35e | 26.02d |
| | 60 cm x 50 cm | 124.50b | 3.45d | 6.50 | 15.85e | 486.60f | 30.71c |
| Bilashi | 60 cm x 30 cm | 114.00c | 4.75b | 6.20 | 43.60a | 886.25a | 49.91a |
| | 60 cm x 40 cm | 105.00d | 4.25c | 3.30 | 29.65b | 859.35b | 45.18b |
| | 60 cm x 50 cm | 92.81e | 3.55d | 7.30 | 24.65c | 824.40c | 31.44c |
| F-test | | * | * | NS | * | * | ** |
| CV (%) | | 12.23 | 8.36 | 8.56 | 10.60 | 9.38 | 11.87 |

Figure in the column having similar letter do not differed significantly by DMRT

Table 3. Investment due to seed cormels and return/ha as influenced by variety and plant spacing in Mukhikachu

| Spacing (cm) | Seed cormel (kg/ha) | Seed cost (Tk./ha) | Gross return (Tk./ha) | Gross margin (Tk./ha) |
|---|---|---|---|---|
| 60 x 30 | 1110 | 6660 | 161240 | 154580 |
| 60 x 40 | 740 | 4440 | 142400 | 137960 |
| 60 x 50 | 550 | 3324 | 101680 | 98356 |

Price (Tk/ha): Seed cormels = 6.00
Harvested cormels= 4.00

# STUDY ON THE LATE PLANTING POTENTIAL OF SOME TOMATO VARTIEIES IN RABI SEASON


## Abstract

An experiment was conducted at the RARS, Rahmatpur, Barisal, FSRD site, Lebukhali, Patuakhali during rabi 2001-02 and RARS, Jessore in 2002-03. Four tomato varieties (BARI Tomato-4, BARI Tomato-5, BARI Tomato-6 & BARI Tomato-10) were planted in five different sowing dates (1 December, 16 December, 1 & 16 January and 1 February). BARI Tomato-4 planted at 16 December performed better and showed that late planting is feasible with reasonable good yield (61.67 t/ha) in 2001-02 but December 1 showed higher yield from BARI Tomato-5 in 2002-03. At Lebukhali, reasonable good yield was obtained from variety BARI Tomato-6 and BARI Tomato-2 which could be grown from Dec. 2 to Jan. 16.


## Introduction

Gradual increase in the price of tomato after the period of seasonal abundance offers an opportunity of growing tomato late in the season to avail the benefit of high market price. Growing a long duration variety that gives good yield towards the end of the growing season or planting suitable varieties as late crop might be useful in this regard. For satisfactory production, such varieties should have high temperature tolerance. However, suitable varieties have not yet been available for such conditions in Bangladesh. In this situation, it is worth while to study the late planting potential of existing varieties and select better one(s) for late planting in different AEZ of the country. So, the trial has been designed to find out the suitable tomato variety for late Rabi.

## Materials and Methods

An experiment was conducted at the RARS, Rahmatpur, Barisal and Lebukhali, Patuakhali during Rabi season 2001-02 & 2002-03 and RARS, Jessore in 2002-03 to find out the potential tomato variety for late Rabi season. The trial was set up in a split plot design with 3 replications. Five planting dates (1 December, 16 December, 1 & 16 January and 1 February) were assigned in the main plots and four tomato varieties (BARI Tomato-5, BARI Tomato-6 and BARI Tomato-10) were assigned in the sub plots. Unit plot size was 3x4 $m^2$ and the seedlings were transplanted following 60 cm x 50 cm spacing. Recommended fertilizer dose and cultural practices were followed as and when necessary. Diethene M-45 and Ridomil were sprayed before flowering. Harvesting continued from 11 March to 22 April 2003 at Jessore. Collected data were analyzed statistically. For mean comparison Duncan Multiple Range Test was calculated.

## Results and Discussions

### Rahmatpur, Barisal

Among five different planting dates, 1 December planting performed better in all respect and gave the highest yield (40.20 t/ha). It is remarkable that plant height, fruit bearing, fruit size, fruit weight as well as Total Soluble Sugar (TSS) decreased with increasing temperature that is planting after December (Table 1).

Among four tomato varieties, BARI Tomato-5 gave the highest yield (23.09 t/ha) followed by BART Tomato-4. Significantly bigger fruit diameter and weight of fruit were produced from BARI tomato-6. Plant height, fruit size, weight and percent TSS (2.46) were higher in BARI Tomato-6 but bearing was less (7.83 fruit/plant). BARI Tomato-4 and BARI Tomato-5 showed higher bearing habit (25.97 and 21.35 fruits/plant). On an average, the highest yield was recorded from BARI Tomato-4.

Interaction between sowing date and variety was found significant in respect of plant height, fruits/plant, fruit length and diameter, TSS (%) and yield (Table 3). Significantly the highest plant height was obtained from $D_1V_3$. The treatment $D_1V_2$ showed significantly the highest fruits/plant. Fruit length revealed higher from treatments $D_1V_4$. Weight of fruit/plant varied from 29 to 94 gm but insignificant. Higher weight from $D_3V_3$ followed by $D_2V_3$. All the varieties sown on December 1 with BARI Tomato-6 showed higher TSS (%). The highest fruit yield was recorded from December 1 sowing of BARI Tomato-5 variety. All the varieties showed lower fruit weight after January 16 sowing. On an average, higher fruit yield was obtained from December sowing (1 t/ha) with BARI Tomato-4 or 6.

**Lebukhali, Patuakhali**

Sowing date influenced significantly only plant height and fruits/cluster similar in the case of variety. Days to flowering, no. of fruits/plant, fruit wt., yield/plant and yield (t/ha) was significantly influenced by sowing date and variety (Table 4). Sowing from Dec. 2 with variety BARI Tomato-6 and BARI Tomato-2 showed higher no. of fruits/plant. Similar trend was followed in case of fruits wt. On an average, the highest yield was obtained from BARI Tomato-2, BARI Tomato-6 in December 2 sowing.

**RARS, Jessore**

Fruits/plant, yield/plant and yields were significantly influenced by sowing date. December 16 and December 1 showed similar yield and the lowest with the advanced of dates. Similar in the case of fruit/cluster and no. of fruits/plant. In case of variety BARI Tomato-5 gave higher yield but at par to BARI Tomato-4. Significantly the highest fruits/cluster and fruits/plant reflected higher yield from BARI Tomato-5. All the yield attributes and yield were significantly influenced by variety and sowing date (Table 7). Significantly the highest fruit yield was obtained from BARI Tomato-6 when sown in December 16. With the advancement of date, yield was decline.

From above result it showed that planting December 1 to 15 BARI Tomato-4 and BARI Tomato-5 performed better with reasonable gave yield at Barisal region. But at Lebukhali, BARI Tomato-6 and BARI Tomato-2 could be grown from Dec. 2 to Jan. 6 with good yield. At Jessore, BARI Tomato-5 planted in December 16 gave higher yield followed by BARI Tomato-4.

Table 1. Effect of sowing dates on the yield and yield components of different Tomato varieties at Rahmatpur, Barisal, 2002-03

| Treatments | Plant height (cm) | Days to 50% flowering | Fruits/ plants | Fruits length (cm) | Fruit diameter (cm) | Fruit weight (gm) | TSS (%) | Yield (t/ha) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 01-02 | 02-03 |
| December 1 | 97.58a | 37a | 38a | 4.89a | 4.31ab | 48.59a | 2.62a | - | 40.20a |
| December 16 | 85.50b | 36ab | 23b | 4.88a | 4.55a | 53.40a | 2.34ab | 43.93a | 27.18ab |
| January 1 | 69.08c | 35ab | 13bc | 4.72a | 4.73ab | 59.43a | 2.30ab | 22.90b | 14.47bc |
| January 16 | 52.75d | 34b | 7c | 4.44b | 3.87bc | 49.97a | 2.12b | 6.25c | 5.83c |
| February 1 | 40.67e | 34b | 2c | 3.76c | 3.43c | 37.48a | 2.08b | 2.38c | 0.88c |
| CV (%) | 10.07 | 11.08 | 21.42 | 6.18 | 9.14 | 17.35 | 6.12 | 22.92 | 26.50 |

Table 2. Effect of variety on the yield and yield components of different Tomato varieties during 2002-03 at Rahmatpur, Barisal

| Treatments | Plant height (cm) | Days to 50% flowering | Fruits/ plants | Fruit length (cm) | Fruit diameter (cm) | Weight /fruit (gm) | TSS (%) | Yield (t/ha) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2001-02 | 2002-03 |
| BARI Tomato-4 | 70.33a | 30.73b | 21.83a | 4.46a | 3.94b | 35.40c | 2.26a | 25.90a | 20.28a |
| BARI Tomato-5 | 78.33a | 35.53ab | 25.97a | 4.44a | 3.71b | 34.02c | 2.33a | 19.17b | 23.09a |
| BARI Tomato-6 | 79.87a | 39.33a | 7.83b | 4.53a | 5.06a | 76.72a | 2.40a | 11.63c | 14.18b |
| BARI Tomato-9 | 45.53b | 34.80ab | 11.36b | 4.73a | 3.67b | 52.95b | 2.18a | 18.79b | 13.31b |
| CV (%) | 10.07 | 11.08 | 21.42 | 6.18 | 9.14 | 17.35 | 6.12 | 22.97 | 26.30 |

Table 3. Interaction effect of different sowing dates and varieties on yield and yield components of Tomato (Rahmatpur, 2001-03)

| Treat-ments | Plant height (cm) | Days to 50% flowering | Fruits/ plant | Fruit length (cm) | Fruit diameter (cm) | Weight/fruit (gm) | TSS (%) | Yield (t/ha) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2001-02 | 2002-03 |
| $D_1V_1$ | 98.00 | 32.00bcdef | 46.80b | 4.51bcd | 3.91bcdef | 31.89d | 2.58b | - | 42.39ab |
| $D_1V_2$ | 110.00 | 35.67abcdef | 56.00a | 4.48hcd | 3.77hcdefg | 29.07f | 2.48hc | - | 47.77a |
| $D_1V_3$ | 122.70 | 41.00a | 18.70ef | 4.81bcd | 5.40a | 84.04ab | 2.95a | - | 36.04b |
| $D_1V_4$ | 59.67g | 38.67abc | 31.63d | 5.78a | 4.17hcd | 49.31cde | 2.4nhc | - | 34.71hc |
| $D_2V_1$ | 85.33de | 31.67cdef | 30.80d | 4.71bcd | 4.37bc | 36.90def | 2.26cdefg | 61.97a | 33.22c |
| $D_2V_2$ | 98.33c | 37.33abcde | 38.50c | 4.86bcd | 4.03bcde | 38.50cdef | 2.33bcdef | 46.75b | 39.75abc |
| $D_2V_3$ | 95.67cd | 39.67ab | 10.20gh | 4.91bc | 5.9Ua | 4.63ab | 2.4~bc | 27.33cd | 1~.66d |
| $D_2V_4$ | 50.67ghij | 33.33abcdef | 13.33fg | 5.03b | 3.9Obcdef | 53.58c | 2. 28cdefg | 39.67b | 17.11de |
| $D_3V_1$ | 71.67f | 30.67def | 17.80ef | 4.85bcd | 4.23bcd | 38.90cdet | 2.26cdet | 30.42c | g 17.11de |
| $D_3V_2$ | 80.00ef | 36.67abcM | 23.13e | 4.75bcd | 3.90bcdef | 3437def | 2.35bcde | 23.17cde | 19.74d |
| $D_3V_3$ | 79.33ef | 39.00abc | 4.70hi | 4.73bcd | 5.50a | 93.54a | 2.40bcd | 16.00ef | 11.16def |
| $D_3V_4$ | 45.33hij | 33.33abcM | 5.93hi | .55bcd | 3.67cdefg | 70.89b | 2.21cdefg | 22.17de | 9.88efg |
| $D_4V_1$ | 54.67ghi | 30.00ef | 9.93gh | 4.43cd | 3.87bcdef | 36.06def | 2.06fgh | 7.67gh | 6.88fgh |
| $D_4V_2$ | 57.67gh | 35.67abcdcf | 8.63gh | 4.33d | 3.60defg | 38.47cdef | 2. 28cdefg | 4.42gh | 6.47fgi1 |
| $D_4V_3$ | 59.00g | 38.00abcd | 4.47hi | 4.49bcd | 4.43b | 70.51b | 2.11efgh | 2.50gh | 4.88fgh |
| $D_4V_4$ | 39.67ik | 33.00bcdef | 4.43hi | 4.50bcd | 3.57defg | 54.82c | 2.05gb | 1.42fg | 4.83fgh |
| $D_5V_1$ | 42.00ijk | 29.33f | 3.80hi | 3.7ge | 3.33erp | 33.25ef | 2.15def | 3.55gh | 1.80.l?,h |
| $D_5V_2$ | 45.67hij | 32.33bcdcf | .57hi | 3.77c | 3.27fg | 29.68f | 2.23cdcfg | 2.33gh | 1.46gb |
| $D_5V_3$ | 42.67ijk | 39.00abc | 1.07i | 3.73e | 3.07 | 50.89cd | 2.06f | 2.00h | 0.15h |
| $D_5V_4$ | 32.33k | 35.67abcdcf | 1.47i | 3.77e | - | 36.11def | 1.90h | 8.75gh | 0.l2h |
| CV (%) | 10.07 | 11.08 | 21.42 | 6.18 | 9.14 | 17.35 | 6.12 | 22.97 | 26.50 |

Table 4. Interaction effect of planting time and variety on the yield of Tomato in rabi season, 2001-03 at Lebukhali, Patuakhali

| Planting time | Variety | Days to 50% flowering | No. of fruits/ plant | Average fruit wt. (gm) | Yield (kg/plant) | Yield (t/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 |
| December 2 | BARI Tomato-4 | 42c | 21c | 34e | 0.714 | 23fg | 22.5fg |
| | BARI Tomato-5 | 39d | 20c | 34e | 0.680 | 25f | 21.8f |
| | BARI Tomato-6 | 45a | 24b | 80a | 1.920 | 72a | 63.0a |
| | BARI Tomato-2 | 46a | 25a | 79a | 1.975 | 73a | 65.6a |
| December 16 | BARI Tomato-4 | 43b | 22bc | 31g | 0.682 | 21fgh | 21.4fgh |
| | BARI Tomato-5 | 40cd | 18de | 32fg | 0.576 | 21fgh | 18.2gh |
| | BARI Tomato-6 | 46a | 26a | 82a | 2.132 | 71ab | 59.0b |
| | BARI Tomato-2 | 44b | 25a | 81a | 2.025 | 68bc | 60.0b |
| January 1 | BARI Tomato-4 | 38d | 18de | 32fg | 0.576 | 20fgh | 18.7gh |
| | BARI Tomato-5 | 37e | 20c | 32fg | 0.640 | 21fgh | 20.5fg |
| | BARI Tomato-6 | 45a | 23b | 79a | 1.817 | 68ab | 58.8b |
| | BARI Tomato-2 | 42c | 25a | 78ab | 1.950 | 68bc | 63.2a |
| January 16 | BARI Tomato-4 | 36e | 19d | 29h | 0.551 | 19gh | 17.6ghi |
| | BARI Tomato-5 | 33g | 17e | 30gh | 0.510 | 19h | 16.3hi |
| | BARI Tomato-6 | 42c | 22bc | 75b | 1.65 | 62d | 52.4b |
| | BARI Tomato-2 | 39d | 24b | 70c | 1.68 | 63cd | 54.8b |
| February 2 | BARI Tomato-4 | 33g | 16f | 28hi | 0.448 | 17h | 14.4hi |
| | BARI Tomato-5 | 34f | 20c | 29 | 0.580 | 19gh | 18.2gh |
| | BARI Tomato-6 | 40cd | 18de | 69cd | 1.242 | 48e | 38.6d |
| | BARI Tomato-2 | 36e | 18de | 66e | 1.188 | 49e | 19.5gh |
| CV (%) | | 6.5 | 8.1 | 7.6 | 8.9 | 4.86 | 10.6 |

Table 5. Effect of planting date on the yield and yield components of late planting tomato at RARS, Jessore during 2002-03

| Planting date | Fruit/cluster | Fruit/plant | Yield/plant (kg) | Yield (t/ha) |
|---|---|---|---|---|
| December 01 | 5.88a | 26.56a | 1.08a | 18.66a |
| December 16 | 5.21b | 21.02b | 0.71b | 20.40a |
| January 01 | 4.20c | 9.78c | 0.33c | 5.57b |
| January 16 | 3.44d | 6.86d | 0.17d | 3.06c |
| February 01 | 3.62d | 3.15e | 0.11e | 1.67c |
| CV (%) | 7.50 | 18.08 | 13.61 | 20.76 |

Table 6. Effect of variety on the yield and yield components of late planting tomato at RARS, Jessore during 2002-03

| Variety | Fruit/cluster | Fruit/plant | Yield/plant (kg) | Yield (t/ha) |
|---|---|---|---|---|
| BARI Tomato-4 | 4.38b | 13.88b | 0.506a | 10.61ab |
| BARI Tomato -5 | 4.67a | 21.47a | 0.517a | 11.15a |
| BARI Tomato -6 | 4.71a | 9.61c | 0.423b | 8.27c |
| BARI Tomato -12 | 4.11c | 8.93c | 0.475a | 9.48bc |
| CV (%) | 7.50 | 18.08 | 13.61 | 20.76 |

Table 7. Interaction effect of planting date and variety on the yield and yield components of late planting tomato at RARS, Jessore during 2002-03

| Planting time | Variety | Fruits/ cluster | Fruits/ plant | Yield/ plant (g) | Yield (t/ha) | Average fruit weight (g) |
|---|---|---|---|---|---|---|
| December 2 | BARI Tomato-4 | 6.37a | 28.57b | 1.19a | 20.24bc | 43 |
| | BARI Tomato-5 | 6.40a | 45.27a | 1.16a | 20.56bc | 25 |
| | BARI Tomato-6 | 6.27a | 15.80d | 0.80b | 14.04e | 50 |
| | BARI Tomato-12 | 4.47cd | 16.60d | 1.17a | 19.79cd | 70 |
| December 16 | BARI Tomato-4 | 4.77c | 23.10c | 0.81b | 23.51ab | 41 |
| | BARI Tomato-5 | 5.60b | 32.53b | 0.71bc | 24.18a | 24 |
| | BARI Tomato-6 | 6.00ab | 14.30de | 0.64c | 16.49de | 44 |
| | BARI Tomato-12 | 4.47cd | 14.17de | 0.66c | 17.44cde | 46 |
| January 1 | BARI Tomato-4 | 4.28cde | 7.87fgh | 0.28de | 5.23fgh | 40 |
| | BARI Tomato-5 | 4.10d-g | 15.60d | 0.38d | 6.15f | 21 |
| | BARI Tomato-6 | 4.20c-f | 9.07fg | 0.37d | 5.83fg | 40 |
| | BARI Tomato-12 | 4.20c-f | 6.57f-i | 0.31de | 5.05fgh | 47 |
| January 16 | BARI Tomato-4 | 3.37hi | 6.47f-i | 0.15f | 2.79fgh | 32 |
| | BARI Tomato-5 | 3.57f-i | 10.27ef | 0.20ef | 3.23fgh | 19 |
| | BARI Tomato-6 | 3.30hi | 6.07f-i | 0.21ef | 3.37fgh | 33 |
| | BARI Tomato-12 | 3.53ghi | 4.63ghi | 0.13f | 2.86fgh | 36 |
| February 2 | BARI Tomato-4 | 3.09i | 3.40hi | 0.10f | 1.71h | 28 |
| | BARI Tomato-5 | 3.70e-i | 3.70hi | 0.14f | 1.94gh | 20 |
| | BARI Tomato-6 | 3.77e-h | 2.80i | 0.10f | 1.63h | 32 |
| | BARI Tomato-12 | 3.90d-h | 2.70i | 0.10f | 1.50h | 34 |
| CV (%) | | 7.50 | 18.08 | 13.61 | 20.76 | - |

# EVALUATION OF CHERRY TOMATO VARIETIES IN DIFFERENT AGRO-ECOLOGICAL REGIONS


## Abstract

An experiment was conducted at Agricultural Research station Bogra during 2000-03 and RARS, Jessore on 2002-03 to find out adaptability and performance of cherry tomato varieties in different agro-ecological zone. After three years experimentation at Bogra, it was found that the variety AT-112 (58.22 t/ha) gave the highest yield followed by AT-113 with yield of 55.54 t/ha. At Jessore, the variety BARI Tomato-1 gave higher yield (19.34 t/ha) followed by BARI Tomato-2 in one year result.


## Introduction

Cherry tomato varieties have recently been introduced in Bangladesh. These are vary rich source of carotene as well as vitamin-C and can play a vital role in improving the nutrition of vast rural masses. However, the recently introduced varieties have not been evaluated in the diverse Agro-ecological regions of the country and farmers' acceptance of the varieties has not been evaluated. Considering the above facts, the trial was undertaken to evaluate the performance of available varieties in different Agro-ecological regions of the country.

## Materials and Methods

The experiment was conducted at Agricultural Research Station, Bogra during Rabi season from 2000-03 and RARS, Jessore on 2002-03. The experiment was laid out in Randomized Complete Block design with three replications. The unit plot size was 3 m x 3 m and the plant spacing was 60 cm x 50 cm. Four varieties AT-110, AT-111, AT-112 and AT-113 obtained from AVRDC and two from BARI (BCT-4 and BCT-5) were tested. The land was thoroughly prepared and fertilization was done with cowdung, Urea, TSP, MP, Gypsum, Boric acid and NH4-molibdate @ 10 t/ha, 100 N, 75 $P_2O_5$, 125 $K_2O$, 40 S, 7.5 B kg/ha and 550 gm/ha respectively. Half of the cowdung, $P_2O_5$ and total amount of Gypsum, Boricacid and NH4-Molibdate were applied during final land preparation. The remaining 50% cowdung and $P_2O_5$ were applied during pit preparation prior to planting. The rest N and $K_2O$ were applied in 2 equal installments at 21 and 35 days after transplantation followed by irrigation. Thirty days old seedlings were transplanted. Azodrin and Ridomil were used for controlling the Aphids and late blight of tomato respectively. Data on date of 50% flowering, plant height, fruit/plant, fruit /cluster, average weight of fruit, seed/fruit, marketable yield/ plant/ha, date of 1st and last harvest were recorded. At Bogra, duration of harvest of different varieties of tomato was recorded which showed variation i.e. AT-110 (27 days, 2-24 April), AT-111 (22 days, 2-24 April), At-112 (21 days, 2-23 April), At-113 (22 days, 2-24 April), BCT-5 (18 days, 22 March-9 April) & BCT-6 (18 days, 22 March-9 April).

## Results and Discussion

### ARS, Bogra

Days to flowering, plant height, yield and yield contributing characters were significantly influenced by different varieties of tomato (Table 1).

The maximum days to 50% flowering (63 days) was recorded from variety AT-112, and minimum from BCT-5 and BCT-4 (47-49 days). The highest plant height was recorded from variety AT-111 and the lowest from BCT-4. Significantly the highest fruit/plant was recorded from variety BCT-4 which differed from other variety. Almost similar trend was followed in case fruit/cluster. But seed/fruit was significantly the highest from variety AT-110. Significantly the highest fruit weight was obtained from variety AT-112 followed by AT-112. The highest yield/plant was recorded from variety AT-113 followed by AT-112. Similar trend was followed in case of yield in 2002-03. Although higher no. of fruits/plant and fruit/cluster in variety BCT-4 and BCT-5 but failed to gave higher yield than At-112 due to less weight of fruit and yield/plant.

From three years result from Bogra showed that the variety AT-112 gave the highest yield (58-92 t/ha) but moderate yield could be obtained from variety AT-111, AT-113 and AT-110 (47-55 t/ha). Though BCT-4 and BCT-5 showed the lowest yield but farmers are interested due to its colour, shape and size. At Jessore, the variety AT-112/AT-113 performed better performance.

**RARS, Jessore**

Plant the height, fruit/cluster, fruit/plant, yield/plant and yield were significantly affected by variety. Significantly the highest plant height was obtained from BCT-5 but significantly the highest fruit/cluster was recorded from BCT-4. The variety BCT-4 & BCT-6 showed similar fruit/plant. Yield/plant gave higher from variety BARI Tomato-1 followed by BARI Totamo-2. The variety BARI Tomato-1 showed higher yield but statistically at par to BARI Tomato-2, BCT-6 and BCT-4.

Table 1. Performance of different characters of six cherry tomato varieties at ARS, Bogra, 2002-2003.

| Varieties/ line | Days to 50% flowering | Plant height (cm) | Fruit/ plant | Fruit/ cluster | Seed/ fruit (no.) | Average (g fruit wt.) | Yield/ plant (kg) | Yield | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 00-01 | 01-02 | 02-03 | |
| AT-110 | 61b | 182.0b | 41d | 1.81c | 102.5a | 61.57b | 1.52b | 45.83c | 52.08c | 49.77b | 49.22 |
| AT-111 | 56c | 188.9a | 40d | 1.88c | 77.67b | 70.18a | 1.45b | 49.74bc | 59.85b | 48.17b | 52.59 |
| AT-112 | 63a | 185.6a | 36d | 1.90c | 76.50b | 73.81a | 1.73a | 55.96a | 61.55a | 57.75a | 58.42 |
| AT-113 | 52b | 186.3a | 106c | 2.75b | 62.17c | 40.68c | 1.89a | 52.61b | 54.01bc | 61.20a | 55.99 |
| BCT-4 | 49c | 144.0c | 370a | 4.12a | 9.17e | 2.37d | 0.81c | 26.69d | 27.85d | 27.03c | 27.19 |
| BCT-5 | 47f | 142.6c | 312b | 3.89a | 13.83d | 2.84d | 0.74c | 27.16d | 33.39d | 26.22c | 28.52 |
| CV(%) | 1.54 | 1.49 | | | 5.66 | 12.55 | 10.17 | 14.15 | 12.29 | 11.24 | |

Table 2. Performance of different characters of six cherry tomato varieties at RARS, Jessore, 2002-03

| Treatment (variety/line) | Plant height (cm) | Fruit/ Cluster | Fruit/plant | Yield/plant (g) | Av. fruit wt. (g) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| BCT-4 | 87.73bc | 11a | 147a | 632.6b | 4.32 | 14.7ab |
| BCT-5 | 99.77a | 10b | 119ab | 602.1b | 5.06 | 13.56bc |
| BCT-6 | 81.57d | 10b | 139a | 660.4b | 4.78 | 16.08ab |
| BCT-7 | 83.52cd | 10b | 98b | 429.6c | 4.46 | 9.78c |
| BARI Tomato-1 | 92.23b | 5c | 23c | 853.8a | 38.10 | 19.34a |
| BARI Tomato-2 | 74.78e | 5c | 21c | 741.7ab | 35.07 | 16.76ab |

# STUDIES ON TURMERIC BASED INTERCROPPING SYSTEM

## Abstract

The experiment was conducted at MLT site Moulvibazar in 2001-02 & 2002-03. On an average, intercropping of turmeric with wax gourd may be profitable instead of sole turmeric or country bean cultivation. Other cultivation failed to show higher benefit cost ratio than sole country bean but all other cultivation showed higher BCR than sole turmeric.

## Introduction

Turmeric is a popular spice crop in Bangladesh. It has multiple uses in dying industries, medicines, culinary preparations and in cosmetics. It is a long duration crop with slow growth in the early stages. Turmeric can be cultivated in shady places as they are shade tolerant crops. So, vegetables can be intercropped with turmeric supported on bamboo on the turmeric plot. Cucurbits and legumes like country bean and yard long bean can easily be grown with supports of bamboo sticks as they are creeping and climbing type of vegetables.

Farmers of Sylhet district usually grow country bean in vast areas mainly as high land field crops. The variety used for country bean is locally called 'Gohalghadda' and very popular to Sylhet's peoples. This variety is now exporting to U.K. On the other hand in Hobigonj district considerable areas of land under turmeric cultivation as a sole crop. In this context, the present investigation was undertaken to know the performance of turmeric based intercropping systems in the Sylhet region.

## Materials and Methods

The experiment was conducted at MLT site, Moulvibazar during 2001-02 & 2002-03. The design was used in RCB with three replications. Plot size was 4 m × 4 m. Five different treatment combination such as Turmeric + wax gourd/country bean, Turmeric + bitter gourd/country bean, Turmeric + country bean, Turmeric sole and country bean sole. Turmeric seeds were sown on 25 April, 2001 and 14 April 2002. Four holes/ pits were made to sow cucurbits seeds at every corner of the plot on the same date of turmeric sowing. Country bean seeds were sown into the same pit on 10 August 2001 and 25 July 2002 just after harvest of cucurbits. For both the experiment turmeric crop was fertilizer @ 10 cowdung and 90-72-120 kg of N, $P_2O_5$ and $K_2O$/ha, respectively. Incase of cucurbits and country bean 3kg cowdung and 20-40-40 g of N, $P_2O_5$ and $K_2O$/ pit were applied. Cucurbits and country bean were allowed to climb on the bamboo support and Yard long bean was allowed to creep with bamboo stick. Earthing up and weeded was done at twice. The average crop duration for turmeric was around 265 days. Cost and benefit analysis was done for each treatment on a hectare basis taking into account the market value of each crop.

## Results and Discussion

**Yield of turmeric:** On an average, maximum turmeric yield (20.90 t/ha) was obtained from turmeric + wax gourd relayed with country bean, followed by turmeric + bitter gourd/ country bean at 19.95 t/ha. The lowest turmeric yield is 18.74 t/ha in sole situation. This reduction is sole cropping situation might be the case of growing turmeric under open sunshine as it likes to grow under partial shade (Table 1).

**Yield of cucurbits:** Among two gourd, higher yield (13.55 t/ha) was obtained from wax gourd. The yield variations between two cucurbits were due to the reason of bearing habit and genetic yield potentiality (Table 1).

**Yield of country bean:** Sole country bean produced higher pod yield (10.09 t/ha) than in intercrop combinations (Table 1).

**Turmeric equivalent yield:** All the intercropping situations showed higher equivalent yield than that of the sole crop. The highest turmeric equivalent yield (52.40 t/ha) was obtained from turmeric + wax gourd relayed with country bean (Table 1).

**Economic analysis:** The economic performance of different intercropped and sole situations were presented in Table 2. The highest gross return (Tk. 320146/ha) and gross margin (Tk. 248270/ha) was recorded in turmeric + wax gourd/country bean combinations followed by turmeric + bitter gourd/ country bean combinations. Benefit cost ratio was also the highest in turmeric + wax gourd/country bean (4.45) combinations. All the intercropping situation showed higher BCR than sole turmeric but only turmeric + was gourd/country bean revealed higher benefit than sole country bean.

The results showed that turmeric intercropping with cucurbits (wax gourd) relayed with country bean gave higher turmeric equivalent yield and monetary advantages than other sole crop combinations. So, farmers of the Moulvibazar region could be motivated to grow turmeric as intercrop with wax gourd relayed with country bean instead of growing sole turmeric and country bean.

Table 1. Yield of turmeric, country bean, cucurbits and turmeric equivalent yield of sole and intercropping combinations at MLT site Moulvibazar during 2001-02 & 2002-03

| Treatments | Turmeric yield (t/ha) | | | Country bean yield (t/ha) | | | Wax gourd yield (t/ha) | | | Bitter gourd yield (t/ha) | | | TEY (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 01-02 | 02-03 | Mean | 01-02 | 02-03 | Mean | 01-02 | 02-03 | Mean | 01-02 | 02-03 | Mean | |
| T+WG+CB | 22.54 | 19.25 | 20.90 | 7.25 | 8.60 | 7.92 | 14.42 | 12.68 | 13.55 | - | - | - | 52.4 |
| T+BG+ CB | 21.10 | 18.80 | 19.95 | 7.64 | 9.10 | 8.37 | - | - | - | 7.15 | 6.72 | 6.94 | 48.10 |
| T+CB | 20.82 | 18.10 | 19.46 | 8.50 | 10.25 | 9.38 | - | - | - | - | - | - | 36.80 |
| T sole | 18.74 | 17.60 | 18.17 | - | - | - | - | - | - | - | - | - | 18.17 |
| CB sole | - | - | - | 9.05 | 11.12 | 10.09 | - | - | - | - | - | - | 18.66 |

T= Turmeric, WG= Wax gourd, BG= Bitter gourd, CB= Country bean, TEY= Turmeric equivalent yield

Table 2. Cost and return analysis of sole and intercropping combination of turmeric, country beans and cucurbits at MLT Moulvibazar, 2001-02 & 2002-03 (average of two years)

| Treatment | Gross return (Tk/ha) | Total variable cost (Tk/ha) | Gross margin (Tk/ha) | Benefit cost ratio (BCR) |
|---|---|---|---|---|
| T + WG + CB | 320140 | 71870 | 248270 | 4.45 |
| T + BG + CB | 302640 | 72660 | 229980 | 4.17 |
| T + CB | 231600 | 61540 | 170060 | 3.76 |
| T sole | 105600 | 36730 | 68870 | 2.88 |
| CB sole | 133440 | 30070 | 103370 | 4.43 |

T= Turmeric, WG= Wax gourd, BG= Bitter gourd, CB= Country bean

| Crops | Price (Tk./kg) | |
|---|---|---|
| | 2001-02 | 2002-03 |
| Turmeric | 6.00 | 6.00 |
| Country bean | 10.00 | 12.00 |
| Wax gourd | 7.00 | 8.00 |
| Bitter gourd | 10.00 | 12.00 |

# PERFORMANCE OF POTATO YAM GROWN ON DIFFERENT SUPPORT


## Abstract

The experiment was conducted at Regional Agricultural Research Station, Jamalpur from March 2001 to January 2002 and April 2002 to January 2003 to determine the suitable support of potato yam grown on different supporting materials viz. i) Cut tree branches, ii) Bamboo trellis and iii) Vertical bamboo support. The experiment was laid out in a randomized complete block design with three replications. On an average, results indicated that the highest total weight of yam/plant was found from bamboo trellis.


## Introduction

Potato yam (*Dioscoria bulbifera*), botanically a bulbil, locally known as *Gach Aloo*, is an uncommon vegetable. The plant is climbing creeper. It is usually grown without care in the homestead trees. The plant is propagated vegetative and once sown, it does not require recurrent sowings. It grows from April to January. Its harvest can be extended up to October whereby supply of the vegetables can be prolonged. Recent studies revealed that it could give a substantial yield. But the farmers do not grow it extensively. Research studies indicated that there is a scope for its production through homestead plantation system. But studies on growing potato yam on other supporting material are very meagre. Therefore, to determine the suitable support of potato yam grown on other supporting materials, the experiment was conducted to find out the suitable support of potato yam.

## Materials and Methods

The experiment was conducted at Regional Agricultural Research Station, Jamalpur during the period from March 2000 to January 2001 and April 2002 to January 2003 .Three supports viz. i) Cut tree branches, ii) Bamboo trellis and iii) Vertical bamboo support were considered as the treatment. Single standard sized germinated yam seed (average weight of 120 g) was planted in the pit in the third week of April, 2001. Well decomposed 5 kg cowdung, 25 g urea, 20 g TSP and 30 g MP/pit was applied and mixed with the soil before planting. Each pit was weeded twice during the entire production period. The yam started flowering in the middle of September and harvesting began from November in both the years. The periodical harvesting continued up to January 2002. The data on yield were statistically analyzed and the means were separated as per LSD test.

## Results and Discussion

Results indicated that total weight of yam/plant was obtained from bamboo trellis which was identical to cut tree branches. Vertical bamboo support produced the lowest yam/plant (Table 1).

Table 1. Performance of potato yam grown on different supporting materials at Narikeli, Jamalpur during 2001-03

| Support | Total weight of yam/plant (kg) | |
|---|---|---|
| | 2001-02 | 2002-03 |
| Cut tree branches | 4.8a | 3.57b |
| Bamboo trellis | 5.9a | 5.47a |
| Vertical bamboo support | 2.8b | 3.38b |
| F | * | * |
| CV% | 10.19 | 8.07 |

Figure in a column having similar/no letter do not differ significantly

# IMPROVEMENT OF PRODUCTIVITY OF YAM THROUGH INTENSIFICATION OF SPACING


## Abstract

The experiment on planting distance of yam (Dioscorea alata) was conducted at RARS farm, Jessore during 2002-2003 in RCBD with four replications. Three planting distance viz. 3.0 x 3.0 m, 1.5 x 1.5 m and 1.0 x 1.0 m were studied. The yam was allowed to grow on ground. The number and yield of both nodal rhizome and main rhizome increased gradually with the increase of spacing. Significantly the highest total yield (14.28 t/ha) was obtained from 1.0 x 1.0 m spacing.


## Introduction

Homesteads are intensively used farming units in Bangladesh agriculture. About 85 percent of the total population in Bangladesh lives in the rural areas (FAO, 1986). Almost every household in rural areas has a homestead. The homesteads are used intensively for growing different types of fruit and forest trees and vegetables along with other uses. Previous studies suggest that crop intensification is one of the ways to improve productivity of the homestead production system (Abedin and Quddus, 1990; Alam *et al*., 1990).

Yam (*D. alata*) is a traditional creeper vegetable usually grown on the homestead trees. It is a popular and costly vegetable but not gown widely. Little attention has been given on this crop in the past to improve its productivity. *D. alata* is grown mainly for underground rhizome. The yam plants also produce aerial bulbils from the nodes. The aerial bulbils do not grow bigger in size. There are usually not consumed as vegetable, since they are not as tasty as the underground rhizome. It was assumed that these aerial bulbils might grow bigger in size and become tasty if they are allowed to grow in the ground. Yield of the crop might also be enhanced with this production technique. Research on these aspects of the crop has not yet been done in the country. The present study was therefore conducted with the objectives to improve productivity of the crop through intensification of spacing and to identify the optimum spacing for growing yam on the ground.

## Materials and Methods

The experiment was conducted at the Regional Agricultural Research Station farm, Jessore during 2002-2003. The experiment was laid out in RCBD with four replications. Three planting spacing viz. 3 m x 3 m, 1.5 m x 1.5 m and 1.0 m x 1.0 m were studied. The yam species *Dioscorea alata* was used as the test species. The unit plots measured 3.0 m x 3.0 m. Pits measuring 50 cm x 50 cm x 50 cm were prepared along with cowdung application during the fourth week of May. Well-rotten cowdung was applied at the rate of 5 kg per pit. Yam was planted also during the third week of April. The yam plants were allowed to grow on the ground. The crop was weeded thrice during the first and fourth week of June and fourth of July. Insecticide (Dimecron) was sprayed during the second week of June. The crop was harvested during the third week of February, 2003. Data on the number and yield of nodal rhizome and main rhizome were recorded and analyzed statistically.

## Results and Discussion

Performance of yam (*D. alata*) grown with different spacing on the ground presented in Table 1. The yam grow well on the ground. The number and yield of both nodal rhizome and main rhizome were increased gradually with the reduction of the spacing. The yam yield with 1.5 x 1.5 m and 1.0 x 1.0 m spacing increased by about 2.50 and 4.21 fold, respectively over that with 3.0 x 3.0m spacing. It is to be noted that the nodal rhizome, contributed a significant amount to the total yam yield. Significantly the highest total yield (14.28 t/ha) was obtained from closer spacing (1.0 x 1.0 m). It is therefore evident that the yield of yam could be increased greatly with reducing the spacing from 3.0 x 3.0 m to 1.0 x 1.0 m. The yam yield might also be increased further with further reduction of spacing. The study will be continued for the next one year for making a sound conclusion.

Table 1. Effect of spacing on the performance of yam grown on the ground at RARS, Jessore during 2002-03

| Spacing | Nodal rhizome | | Main rhizome | | Total yield (t/ha) |
|---|---|---|---|---|---|
| | Number/ha | Yield (t/ha) | Number/ha | Yield (t/ha) | |
| 3.0m x 3.0m | 63889 | 1.22b | 1111 | 2.17c | 3.39c |
| 1.5m x 1.5m | 150000 | 3.14ab | 4444 | 5.42b | 8.56b |
| 1.0m x 1.0m | 216666 | 5.19a | 10000 | 9.09a | 14.28a |

**References**

Abedin, M.Z. and Quddus, M.A., 1990. Homestead fuel situation, Homegarden and Agroforestry practice at six Agro-ecologically different location of Bangladesh, Homestead plantation and Agroforestry in Bangladesh. pp 19-53.

Alam, M.S., M.F. Haque, M.Z. Abedin and S. Aktar. 1990. Homestead trees and household fuel uses in and around FSR site, Jessore. In Proceedings of a National Workshop on 'Homestead Plantation and Agroforestry in Bangladesh' held on 17-19 July 1988 in Joydebpur, Bangladesh, pp. 105-119.

FAO, 1986. Community Forestry Handbook. ADB Community Forestry Project. FAO/UNDP/ BGD/81/028, Dhaka, p. 60.

# INTERCROPPING OF YARD LONG BEAN WITH CHILLI


## Abstract

The experiment was conducted at farmers' field in Hathazari of Chittagong district during December 2001 to May 2002 and December 2002 to May 2003 to identify adequate plant population of Yard long bean and to determine the proper sowing time of Yard long bean with Chilli in Yard long bean and Chilli intercropping systems. Three plant populations of Yard long bean viz., 10 , 20 & 30 %, and four sowing times of Yard long bean viz., at the time of Chilli planting, 30 days after Chilli planting, 60 days after Chilli planting & 90 days after Chilli planting were studied. Twenty percent of yard long bean plant population at the time of Chilli planting showed the highest chilli equivalent yield (1.92 t/ha) and benefit-cost ratio (4.00).


## Introduction

The farmers of Chittagong region usually grow yard long bean scaterdly with Chilli and used Chilli plant as support of yard long bean. They do not maintain definite plant population and exact sowing time of yard long bean. They also do not measure the cost and return analysis of this intercropping systems. The literature in this regard is meagre. The present study was, therefore, taken in hand to know the proper sowing time, adequate plant population and also cost and return analysis of chilli and Yard long bean intercropping systems.

## Materials and Methods

The experiment was conducted at farmers' field in Hathazari of Chittagong district during December 2001 to May 2002 and December 2002 to May 2003. The land was medium high land having sandy loam in nature. The experiment was laid out in a randomised complete block design with four dispersed replications. Three plant populations of Yard long bean viz., 10, 20 & 30 %, and four sowing times of Yard long bean viz., at the time of Chilli planting, 30 days after Chilli planting, 60 days after Chilli planting & 90 days after Chilli planting were studied. The treatment combinations were as follows:

$T_1$= Sole Chilli
$T_2$=Chilli + 10 % Yard long bean at the time of Chilli planting
$T_3$= Chilli + 20 % Yard long bean at the time of Chilli planting
$T_4$= Chilli + 30 % Yard long bean at the time of Chilli planting
$T_5$= Chilli + 10 % Yard long bean at 30 days after Chilli planting
$T_6$= Chilli + 20 % Yard long bean at 30 days after Chilli planting
$T_7$= Chilli + 30 % Yard long bean at 30 days after Chilli planting
$T_8$= Chilli + 10 % Yard long bean at 60 days after Chilli planting
$T_9$= Chilli + 20 % Yard long bean at 60 days after Chilli planting
$T_{10}$= Chilli + 30 % Yard long bean at 60 days after Chilli planting
$T_{11}$= Chilli + 10 % Yard long bean at 90 days after Chilli planting
$T_{12}$= Chilli + 20 % Yard long bean at 90 days after Chilli planting
$T_{13}$= Chilli + 30 % Yard long bean at 90 days after Chilli planting
$T_{14}$= Sole Yard long bean

Chilli and yard long bean (fruit type short and whitish-green in colour) variety was Hathazari local. Unit plot size was 6 m x 3 m. Spacing of Chilli was 50 cm x 15 cm and spacing of sole yard long bean was 150 cm x 30 cm. Chilli was planted in the 2$^{nd}$ week of December in both the years and ripened chilli was harvested during 2nd week of April to last week of May. Yard long bean was sown according to treatments and was harvested during 3rd week of March to 3rd week of May by hand picking at 3 days interval. Fertilizer was applied at 100 Kg N, 64 Kg P, 100 Kg K per hectare in the form of Urea, Triple super phosphate and muriate of potash. Entire TSP and MP were applied as basal dose. Urea was applied in three equal splits at 15, 35 & 65 days after planting of Chilli. Gap filling of

Chilli was done after 12 days of planting. Irrigation was applied 3 times at 15, 35 and 65 days after planting. Weeding, earthing up and other intercultural operations were done as and when necessary. plant protection measures against aphids and fruit borer was taken. Data on yield of Chilli (dried) on whole plot basis, number and weight of Chilli per plant, and 100 Chilli weight were recorded and analysed statistically. Data on yield of green yard long bean, number and weight of yard long bean were recorded. Chilli equivalent yield and benefit cost ratio was analysed . Maximum temperatures for the month of Nov., Dec., Jan., Feb., March, April and May at RARS, Hathazari, Chittagong during were 29.9, 29.3, 30.5, 29.8, 30.7, 30.8 and $31.7^{0c}$ and minimum temperatures for those month were 16.9, 11.8, 14.6, 13.5, 18.8, 22.6and $23.37^{0c}$ . Rainfall for the month of Nov., Dec., Jan., Feb., March, April and May at RARS, Hathazari, Chittagong were 91.9, 90.9, 91.7, 91.0, 78.7, 91.6 and 91.93 mm.

## Results and discussion

Number, weight and yield of dried Chilli were significantly varied in both the years (Table1). The higher number of Chilli per plant was found from treatment $T_1$ where sole Chilli was grown in both the years but was statistically similar to treatments $T_{11}$, $T_{12}$ & $T_{13}$ in 2001-2002. Due to higher competition with yard long bean, Chilli number per plant was lower at the time of Chilli planting but after that there was an increasing trend due to lesser competition with the late planting of yard long bean. At early planting time, there was an decreasing trend of chilli per plant with the increasing of yard long bean plant population. Similar trend was found in case of weight of Chilli per plant and yield of Chilli in both the years. Number and weight of yard long bean per plant decreased with the later planting , but increased with the higher plant population of yard long bean (Table 2). When yard long bean was sown at 90 days after Chilli planting, the plants did not establish up to bearing of fruits. Yard long bean yield decreased with late planting but increased with the increase of yard long bean plant population. Highest chilli equivalent yield was recorded from chilli + 20% YLB. It was noted that 10 to 30% population of yard long bean showed higher CEY than sole Chilli. Other intercropped treatments failed to show higher CEY than sole chilli. Similar trend was followed in case of gross returns and benefit cost ratio.

### Recommendation

From two year result showed that higher yield and monetary benefit was recorded from chilli+30% YLB at the time of chilli planting. So, farmers of Chittagong should be motivated to grow chilli+YLB instead of chilli.

Table 1. Yield and yield attributes of Chilli in yard long bean and chilli intercropping system (Hathazari, Chittagong in 2001-02 and 2002-03)

| Treatment | Fruit/plant (no.) | | Wt. of fruit/plant (g) | | Fruit yield (t/ha) | |
|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | 2001-02 | 2002-03 | 2001-02 | 2002-03 |
| $T_1$ | 23.03a | 28.53a | 61.17a | 65.78a | 1.30a | 1.60a |
| $T_2$ | 15.97def | 18.82de | 39.00c | 44.96e | 1.00b-e | 1.20de |
| $T_3$ | 15.97def | 16.01fg | 36.83c | 36.92f | 0.96c-g | 1.06ef |
| $T_4$ | 14.33ef | 13.17h | 37.67c | 32.62g | 0.73e | 0.96f |
| $T_5$ | 15.03ef | 19.21de | 40.33c | 47.18de | 1.06a-d | 1.28cd |
| $T_6$ | 14.33ef | 17.23ef | 39.00c | 43.73e | 0.95c-e | 1.15de |
| $T_7$ | 13.20f | 14.24gh | 36.83c | 36.15fg | 0.91de | 0.97f |
| $T_8$ | 19.03cd | 22.64c | 54.67ab | 61.04bc | 1.13a-d | 1.53ab |
| $T_9$ | 17.07cde | 22.28c | 54.67ab | 58.28c | 1.13a-d | 1.46ab |
| $T_{10}$ | 19.07bcd | 20.02d | 47.00bc | 50.34d | 1.18abc | 1.41bc |
| $T_{11}$ | 21.10ab | 26.04b | 60.33a | 63.45ab | 1.22ab | 1.58a |
| $T_{12}$ | 21.03ab | 25.67b | 54.00cd | 49.91bc | 1.20abc | 1.48ab |
| $T_{13}$ | 19.80abc | 24.58bc | 52.67ab | 58.38c | 1.16abc | 1.45ab |
| $T_{14}$ | -- | | -- | -- | | |
| LSD(0.05) | 3.246 | 2.216 | 11.26 | 3.866 | 0.2323 | 0.1507 |
| Cv (%) | 10.94 | 6.37 | 14.15 | 4.53 | 13.01 | 6.59 |

Table 2. Yield and yield attributes of Yard longbean in yard long bean and chilli intercropping system (Hathazari, Chittagong in 2001-02 and 2002-03)

| Treatment | Fruit/plant (no.) | | Fruit wt./plant (Kg) | | Fruit yield (t/ha) | |
|---|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | 2001-02 | 2002-03 | 2001-02 | 2002-03 |
| $T_1$ | --- | -- | -- | -- | -- | -- |
| $T_2$ | 196 | 182 | 1.81 | 1.78 | 2.86 | 3.22 |
| $T_3$ | 136 | 122 | 1.29 | 1.17 | 5.68 | 5.14 |
| $T_4$ | 118 | 98 | 1.09 | 0.96 | 5.83 | 5.36 |
| $T_5$ | 72 | 68 | 0.55 | 0.59 | 0.82 | 0.86 |
| $T_6$ | 33 | 38 | 0.41 | 0.42 | 0.93 | 0.97 |
| $T_7$ | 35 | 33 | 0.28 | 0.31 | 1.72 | 1.39 |
| $T_8$ | 16 | 26 | 0.15 | 0.22 | 0.10 | 0.29 |
| $T_9$ | 12 | 18 | 0.08 | 0.14 | 0.33 | 0.41 |
| $T_{10}$ | 10 | 14 | 0.09 | 0.11 | 0.47 | 0.53 |
| $T_{11}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_{12}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_{13}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_{14}$ | 54 | 49 | 0.47 | 0.45 | 8.69 | 8.32 |

Table 3. Chilli equivalent yield, and cost and return analysis of yard long bean and chilli intercropping system (Hathazari, Chittagong average of 2001-02 and 2002-03)

| Treatment | Yield (t/ha) | | Chilli equivalent yield (t/ha) | Gross return (Tk./ha) | Total variable cost (Tk./ha) | Benefit-cost ratio |
|---|---|---|---|---|---|---|
| | Chilli | Yard long bean | | | | |
| $T_1$ | 1.45 | -- | 1.45 | 101500 | 31710 | 3.20 |
| $T_2$ | 1.10 | 3.40 | 1.66 | 116200 | 32810 | 3.54 |
| $T_3$ | 1.01 | 5.41 | 1.92 | 134400 | 33610 | 4.00 |
| $T_4$ | 0.85 | 5.60 | 1.79 | 125300 | 34110 | 3.67 |
| $T_5$ | 1.17 | 0.84 | 1.32 | 92400 | 32710 | 2.82 |
| $T_6$ | 1.05 | 0.95 | 1.21 | 84700 | 33310 | 2.54 |
| $T_7$ | 0.94 | 1.56 | 1.21 | 84700 | 33810 | 2.51 |
| $T_8$ | 1.33 | 0.20 | 1.42 | 99400 | 32810 | 3.03 |
| $T_9$ | 1.30 | 0.37 | 1.36 | 95200 | 32225 | 2.95 |
| $T_{10}$ | 1.30 | 0.50 | 1.38 | 96600 | 32850 | 2.94 |
| $T_{11}$ | 1.40 | 0 | 1.40 | 98000 | 32300 | 3.03 |
| $T_{12}$ | 1.34 | 0 | 1.34 | 93800 | 32300 | 2.90 |
| $T_{13}$ | 1.31 | 0 | 1.31 | 91700 | 32300 | 2.84 |
| $T_{14}$ | -- | 8.51 | 1.41 | 98700 | 37850 | 2.61 |

Price:
Chilli= 12.00 Tk./kg
Yard long bean = 70.00 Tk./kg.

# STUDY ON THE LATE PLANTING POTENTIAL OF TOMATO VARIETIES IN THE RABI SEASON UNDER AEZ-23


## Abstract

The experiment was conducted at Regional Agricultural Research Station, Hathazari, Chittagong during November 2002 to May 2003 to study the late planting potential of BARI released summer tomato varieties in Chittagong region (AEZ-23). Three varieties ( BARI Tomato 4, BARI Tomato 5 and BARI Tomato 6) and five sowing dates ( December 1, 2002, December 16, 2002, January 1, 2003, January 16, 2003 and February 1, 2003 )were studied. Considering yield and benefit-cost ratio, BARI Tomato 4 and BARI Tomato 5 could be sown up to 16th January as late crop.


## Materials and Methods

The experiment was conducted at Regional Agricultural Research Station (RARS), Hathazari, Chittagong during November 2002 to May 2003. The land was medium high land having sandy loam in nature. The experiment was laid out in a two factor randomised complete block design with three replications. Three varieties ( BARI Tomato 4, BARI Tomato 5 and BARI Tomato 6) and five sowing dates (December 1, 2002, December 16, 2002, January 1, 2003, January 16, 2003 and February 1, 2003) were studied. Unit plot size was 3 m x 4 m. Spacing was 60 cm x 50 cm. Thirty days old tomato seedling was planted at each planting date. Fertilizer dose per hectare was cowdung 10 ton, N 100 Kg, $P_2O_5$ 75 Kg, $K_2O$ 125 Kg, Gypsum 150 Kg, Boric acid 7.5 Kg and $NH_4$ Molibdate 550 Gram. Half of cowdung, $P_2O_5$ & total amount of Gypsum, Boric acid & $NH_4$ Molibdate are to be applied the final land preparation. The remaining 50% cowdung & $P_2O_5$ are to be applied during pit preparation prior to planting. The rest N and $K_2O$ are to be applied in 2 equal installments at 21 and 35 days after transplanting. Irrigation, weeding and other intercultural operations, staking, etc. were done as and when necessary. Tomato fruits are partially infested by fruit borer specially in BARI Tomato 6. A few plants of BARI Tomato 4 and BARI Tomato 5 were also virus infected. Tomato fruits were harvested by hand picking at two days interval. Data on Fruits per plant, weight of fruits per plant, fruit yield (whole plot basis), plant height and harvest period were recorded and analysed statistically. Cost and return analysis was also performed. Maximum temperatures for the month of Nov., Dec., Jan., Feb., March, April and May at RARS, Hathazari, Chittagong during were 29.9, 29.3, 30.5, 29.8, 30.7, 30.8 and $31.7^{0c}$ and minimum temperatures for those month were 16.9, 11.8, 14.6, 13.5, 18.8, 22.6and $23.37^{0c}$ . Rainfall for the month of Nov., Dec., Jan., Feb., March, April and May at RARS, Hathazari, Chittagong were 91.9, 90.9, 91.7, 91.0, 78.7, 91.6 and 91.93 mm.

## Results and discussion

Treatments showed significance effect on plant height, number of fruits per plant, weight of fruit per plant, fruit yield and also harvest period (Table 1). Significantly higher plant height was recorded from BARI Tomato –6 when sown on 1st December. There was a trend to decrease plant height with late sowing up to 16 January of all varieties. December 1 to December 16 showed higher fruit/plant in BARI Tomato 5 & BARI Tomato-4. BARI Tomato-6 showed lowest fruit/plant when shown from December 1 to January 16. Fruits/plant revealed higher from variety BARI Tomato-4 but statistically identical to BARI tomato-5 & BARI Tomato-6 when sown from December1 to December 16. Higher fruit yield was recorded from BARI tomato-4 when sown on December 1but statistically at par to BARI Tomato-5. The variety BARI Tomato –6found long time to harvest when sown in December 1. Higher gross return and gross margin was obtained from variety BARI Tomato-6. When sown on 1 December but close to BARI tomato-5 and BARI Tomato-4. Similar trend was noted in case of benefit cost ratio. But it was noted that all the varieties showed reasonable higher BCR because of price of Tomato at that time higher. From one year result showed that all the variety (BARI Tomato-4, BARI Tomato-5 and BARI Tomato-6) could be sown from 1 December to 16 January but higher monetary could be obtained when sown in December and late January but first week to Mid January showed lower BCR because of market price of Tomato was lower at that time.

Table 1. Yield and yield attributes of tomato as affected by sowing time and variety conducted at RARS, Hathazari, Chittagong in 2002-03

| Treatment | Plant ht. (cm) | Fruits/plant (No.) | Fruit wt./plant (Kg) | Fruit yield (t/ha) | Period of harvest (Day) |
|---|---|---|---|---|---|
| $S_1V_1$ | 77.73g | 55.47ab | 2.03a | 59.25a | 39b |
| $S_1V_2$ | 92.30e | 56.93a | 1.97ab | 59.60a | 30c |
| $S_1V_3$ | 124.10a | 18.57f | 1.56abcd | 51.54bc | 43a |
| $S_2V_1$ | 72.40hi | 56.87a | 1.84abc | 51.59bc | 25def |
| $S_2V_2$ | 75.43gs | 53.10abc | 1.55abc | 53.74ab | 24efg |
| $S_2V_3$ | 115.70b | 18.90f | 1.43cd | 46.93cd | 37b |
| $S_3V_1$ | 70.39i | 45.03bcd | 1.48bcd | 46.79bcd | 22fg |
| $S_3V_2$ | 74.87gh | 44.20cd | 1.40cd | 46.82cd | 21g |
| $S_3V_3$ | 112.30c | 18.07f | 1.26def | 35.44e | 28cd |
| $S_4V_1$ | 54.97k | 35.60de | 1.31de | 43.09d | 21g |
| $S_4V_2$ | 61.02j | 42.93cd | 1.35cd | 41.89d | 21g |
| $S_4V_3$ | 102.70d | 18.33f | 1.47bcd | 35.30e | 26de |
| $S_5V_1$ | 52.10k | 27.33ef | 0.75g | 17.98fg | 14h |
| $S_5V_2$ | 52.80k | 30.87e | 0.84efg | 18.76fg | 14h |
| $S_5V_3$ | 85.37f | 17.80f | 0.80fg | 16.96g | 21g |
| CV (%) | 2.30 | 16.61 | 18.95 | 8.81 | 8.75 |
| LSD (0.05) | 3.14 | 9.99 | 0.44 | 6.19 | 3.76 |

$S_1$ = December 1, 2002, $S_2$ = December 16, 2002, $S_3$ = January 1, 2003, $S_4$ = January 16, 2003,$S_5$ = February 1, 2003 and $V_1$ = BARI Tomato 4 , $V_2$ = BARI Tomato 5 ,$V_3$ = BARI Tomato 6

Table 2. Harvest period and cost and return analysis of tomato as affected by sowing time and variety conducted at RARS, Hathazari, Chittagong in 2002-03

| Treatment | Gross return (Tk./ha) | Total variable cost (Tk./ha) | Gross margin (Tk./ha) | Benefit-cost ratio |
|---|---|---|---|---|
| $S_1V_1$ | 296250 | 50553 | 245697 | 5.86 |
| $S_1V_2$ | 298000 | 50553 | 247447 | 5.89 |
| $S_1V_3$ | 309240 | 52328 | 256912 | 5.91 |
| $S_2V_1$ | 206360 | 50553 | 155807 | 4.08 |
| $S_2V_2$ | 214960 | 50553 | 164407 | 4.25 |
| $S_2V_3$ | 234650 | 51960 | 182690 | 4.52 |
| $S_3V_1$ | 187160 | 48107 | 139053 | 3.89 |
| $S_3V_2$ | 187280 | 48107 | 139173 | 3.89 |
| $S_3V_3$ | 177200 | 49200 | 128000 | 3.60 |
| $S_4V_1$ | 215450 | 45328 | 170122 | 4.75 |
| $S_4V_2$ | 209450 | 45328 | 164122 | 4.62 |
| $S_4V_3$ | 211800 | 46136 | 165664 | 4.59 |
| $S_5V_1$ | 107880 | 42136 | 65744 | 2.56 |
| $S_5V_2$ | 112560 | 42136 | 70424 | 2.67 |
| $S_5V_3$ | 118720 | 43228 | 75492 | 2.75 |

Average price of fruit of BARI Tomato 4 and BARI Tomato 5 for 1$^{st}$, 2$^{nd}$, 3$^{rd}$, 4$^{th}$ & 5$^{th}$ sowing time were 5, 4, 4, 5 & 6 taka per kilogram respectively. On the other hand, the average price of fruit of BARI Tomato 6 for 1$^{st}$, 2$^{nd}$, 3$^{rd}$, 4$^{th}$ & 5$^{th}$ sowing time were 6, 5, 5, 6 & 7 taka per kilogram respectively.

**(Coastal Farming)**

# EFFECT OF SOWING TIME ON THE YIELD OF MUNGBEAN IN SALINE AREA

## Abstract

An experiment was conducted at FSRD site, Atkapalia, Noakhali during the rabi 2001-03 to find out the optimum sowing time of Mungbean in saline area. Four sowing dates viz., 31 December, 10 January, 20 January and 2 February were included. On an average, among the sowing date maximum yield was obtained from 30 January sowing 756 kg/ha.

## Introduction

Mungbean (*Vigna radiata* L. Wilczek) is one of the most important pulse crops in Bangladesh. It is one of the important sources of protein for both man and domestic animals. It has good digestibility and flavour. This crop, like other pulses, has the potential to enrich soils through nitrogen fixation. In the FSRD site Atkapalia, Noakhali, Mungbean is cultivated in the pre-kharif season when salinity is a major problem. Salinity increases in the root zone through upward movement of moisture and affects the crop. As a result yield decreases. If Mungbean sown in time it could be harvested avoiding the effect of salinity before increasing of salinity to its peak period. So time of sowing is very important for Mungbean cultivation successfully. With the view in mind, it is needed to know the optimum sowing time of Mungbean after harvest of T.Aman rice.

## Materials and Methods

The experiment was conducted at FSRD site, Atkapalia, Noakhali during rabi season 2001-03. The design of the experiment was RCB with four dispersed replications. The unit plot size was 8 m x 4 m. The variety of Mungbean was BARI Mung-4. Field was fertilized with 45, 85 and 35 kg/ha of urea, TSP and MP, respectively. All fertilizers were applied as basal during each time of sowing. Four sowing times were i.e. 31 December, 10 January, 20 January and 30 January included as treatment. Salinity and moisture of the field were recorded by collecting soil from the date of sowing and every 15 days interval up to harvesting. Data on plant height, plant/m$^2$, branch/plant, and pods/plant were recorded from 10 randomly selected plants. Seed yield was determined as whole plot basis. The collected data were analyzed statistically and means were separated with LSD test.

## Results and Discussion

Plants height, branch/plant, pods/plant, length of pod, seeds/pod and seed yields were significantly influenced by different sowing dates except 1000-seed weight. Plant height showed higher in 30 January sowing followed by 20 & 10 January sowing. Plants/m$^2$ was influenced by sowing date where 30 and 20 January date identical. Significantly the highest pod/plant was obtained from 30 January sowing Seed/pod was statistically identical except 31 December sowing. Seed yield increased with the advancement of date of sowing where 30 January sowing showed maximum yield followed by 20 January sowing. From the above study it may revealed that 20 January to 30 January could be feasible to Mungbean at saline area, Noakhali.

Table 1. Yield and yield attributes of Mungbean by different sowing dates at FSRD site, Atkapalia, Noakhali during 2002-03

| Treatment | Plant ht. (cm) | Plant/ m$^2$ | Pod /Plant | Pod length (cm) | Seed /pod | 1000-seed wt (g) | Seed yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 01-02 | 02-03 |
| 31 December | 28.66b | 35.0b | 8b | 7.44b | 7.06b | 40.98 | 323c | 335c |
| 10 January | 30.33a | 33.8b | 10a | 8.30a | 9.36a | 41.68 | 501bc | 365c |
| 20 January | 31.94a | 40.8ab | 11ab | 8.83a | 9.64a | 41.68 | 687ab | 563b |
| 30 January | 32.18a | 45.6a | 14a | 8.78a | 9.84a | 41.64 | 791a | 722a |
| LSD (0.05) | 1.96 | 7.86 | 3.37 | 0.72 | 0.81 | NS | 252.2 | 136.0 |
| CV (%) | 4.59 | 14.59 | 23.20 | 6.31 | 6.57 | 1.64 | 27.40 | 19.89 |

# EFFECT OF TIME OF SOWING ON THE PERFORMANCE OF MUNGBEAN VARIETIES IN THE SOUTHERN REGION OF BANGLADESH


## Abstract

On-farm experiment was conducted at Farming Systems Research and development (FSRD) site Lebukhali to determine optimum sowing time and variety of Mungbean for the southern region of Bangladesh during the rabi seasons of 2002-03. Four varieties, viz. BARI Mung-2 (Kanti) ,BARI Mung-3, BARI Mung-4, and BARI Mung-5 were sown at four different dates i.e. 1 January, 15 January, 1 February and 15 February. Result revealed that 15 February sowing showed the highest yield (144 kg/ha) with variety is BARI Mung-5


## Introduction

Mungbean (*Vigna radiata* L. Wilczek) is one of the most important pulses crop in Bangladesh. Mungbean is cultivated with minimum land preparation, without weed control, fertilizer application, and diseased control. All these factors are responsible for poor yield of Mungbean. Average Mungbean yield is 514 kg/ha in Bangladesh. About 57.5% of total Mungbean cultivated area is at southern region on coastal belt of Bangladesh. Farmers at this region did not pay due attention to the Mungbean cultivation. They cultivated Mung bean under rainfed condition under residual moisture with minimum management. In greater Patuakhali district about 70% of the arable land remains fallow during winter. Again among the crops grown in 30% of the land pulse crop mainly Mungbean and khesari are the major rabi crops of this area.

## Materials and Methods

The experiment was conducted in the farmers' field at Farming systems research and development (FSRD) site, Lebukhali (AEZ 13) during rabi seasons of 2002- 2003 under rainfed condition. The experiment was carried out using the split plot design with 4 replications. Sowing date constituted the main plots and cultivars in sub plots. Four date of sowing, such as, 1 January, 15 January, 1 February and 15 February and four varieties of *Vigna spp*. viz. BARI Mung-2 (Kanti), BARI Mung-3, BARI Mung-4 and BARI Mung-5 were used in the experiment. The unit plot size was 8 m x 5 m .The land was fertilized with NPK @ 10-8 -10 per hectare at final land preparation. Seeds were sown in line. The distance between the rows was 30 cm and between plants was continuous. The plants were sprayed with Malathion for the control of pod borer.

## Results and Discussion

### Effect of sowing dates

Significantly the highest plants/m$^2$ was recorded from 15 February sowing. Early sowing (1 January) showed the lowest plants/m$^2$ due to cool temperature affect germination (Table 1). Higher yield was obtained from 15 February sowing could be due to the highest plant population per square meter, pods/plant and 1000-seed weight. The lower seed yield obtained from January sowing was due to lower number of plant /m$^2$ because of lower temperature affects the germination.

### Effect of cultivars

The cultivars significantly influenced on yield and yield contributing characters except seed/pods. Significantly the highest plants/m$^2$ was recorded from variety BARI Mung-5 and the lowest plants/m$^2$ was recorded from variety BARI Mung-3 which might be due to lower germination (Table-2). Plants/m$^2$ statistically identical in variety BARI Mung-2 and BARI Mung-4. Significantly the highest 1000-seed weight was recorded from variety BARI Mung-5. Significantly the highest seed yield was obtained from BARI Mung-5 which might be due to higher plants/m$^2$ and bolder 1000-seed weight. The lower yield (688 kg/ha) was recorded from BARI Mung-3 which might be due to less number of plants per meter and lower seed per pods.

**Interaction between sowing dates and cultivars**

Seed yield and other attributes were significantly influenced by the interaction of sowing dates and cultivars. The highest seed yield (1445 kg/ha) was produced by BARI Mung-5 when sown on 15 February. Higher seed yield of BARI Mung-5 than that of BARI Mung-2 (Kanti) might be due to higher plants per square meter and bolder seed weight.

The lowest yield was obtained from 1 January sowing by all cultivars probably due to lower temperature and wetness of soil. So, seeds could not be germinated properly. Many plants were affected by cold injury and most of them were damaged by lower temperature and wetness of soil. Thereby less number of plants/m$^2$ and seeds/pod was recorded. In constract, the above attributes were higher in 15 February. Thus the result suggested that under Patuakhali condition the optimum time of Mungbean sowing is the 2$^{nd}$ week of February. Among the cultivars tested BARI Mung-5 performed best followed by BARI Mung-2 (Kanti).

Table 1. Yield and yield components of Mungbean as affected by dates of sowing in rabi 2002-03

| Date of sowing | Plants/m$^2$ (no.) | Pod/plant (no.) | Seeds/pod (no.) | 1000-seed wt. (g) | Yield (kg/ha) |
|---|---|---|---|---|---|
| Jan -1 | 20.67 | 10.95 | 7.67 | 27.88 | 496.00 |
| Jan -15 | 28.95 | 10.02 | 9.74 | 27.91 | 774.69 |
| Feb -1 | 34.06 | 9.92 | 9.44 | 28.06 | 877.83 |
| Feb-15 | 39.13 | 11.27 | 9.41 | 28.35 | 1143.41 |
| CV (%) | 2.8 | 3.1 | 2.5 | 1.3 | 4.6 |
| LSD | 1.38 | 0.50 | 0.33 | - | 57.8 |

Table 2. Yield and yield components of Mungbean as affected by varieties in rabi 2002-03

| Variety | Plants/m$^2$ (No.) | Plant height (cm) | Pod/plant (No.) | Seeds/pod (No.) | 1000 seed wt. (g) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| $V_1$ | 31.19 | 40.86 | 11.00 | 8.99 | 24.71 | 758.38 |
| $V_2$ | 30.93 | 41.52 | 10.47 | 8.61 | 24.62 | 687.93 |
| $V_3$ | 31.69 | 41.45 | 10.24 | 8.88 | 24.61 | 708.29 |
| $V_4$ | 32.08 | 42.55 | 10.36 | 8.80 | 38.44 | 1105.47 |
| LSD( 0.05) | 0.64 | 1.70 | 0.42 | - | 0.66 | 34.10 |
| CV % | 1.3 | 2.0 | 2.5 | 3.5 | 1.5 | 2.6 |

V1= BARI Mung-2(kanti) , V2= BARI Mung-3 , V3= BARI Mung-4, V4 = BARI Mung-5

Table 3. Yield and yield components of Mungbean as affected by sowing time and varieties in 02-03

| Sowing time | Variety | Plants /m$^2$ (no.) | Pod/plant (no.) | Seeds/pod (no.) | 1000 seed wt. (g) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| January 1 | V1 | 19.80 | 11.41 | 7.56 | 24.88 | 431.61 |
| | V2 | 19.63 | 10.47 | 7.49 | 24.48 | 376.71 |
| | V3 | 20.38 | 10.39 | 7.67 | 24.19 | 404.58 |
| | V4 | 22.88 | 11.23 | 7.85 | 37.95 | 711.08 |
| January 15 | V1 | 27.80 | 11.07 | 9.87 | 24.36 | 727.50 |
| | V2 | 28.81 | 9.90 | 9.43 | 24.41 | 651.25 |
| | V3 | 29.69 | 9.35 | 9.85 | 24.52 | 662.50 |
| | V4 | 29.50 | 9.77 | 9.79 | 38.35 | 1057.50 |
| February 1 | V1 | 35.08 | 10.02 | 9.75 | 24.70 | 832.95 |
| | V2 | 33.31 | 9.82 | 9.31 | 24.33 | 732.71 |
| | V3 | 33.75 | 9.80 | 9.39 | 24.80 | 755.26 |
| | V4 | 34.10 | 10.05 | 9.32 | 38.40 | 1190.39 |
| February 15 | V1 | 38.66 | 11.99 | 9.69 | 24.87 | 1095.75 |
| | V2 | 38.94 | 11.35 | 9.15 | 24.85 | 987.50 |
| | V3 | 39.56 | 11.16 | 9.70 | 24.86 | 1045.00 |
| | V4 | 39.38 | 10.56 | 9.10 | 38.81 | 1445.39 |
| LSD | | 2.14 | 0.89 | 0.73 | 1.25 | 99.01 |
| CV (%) | | 5.7 | 6.2 | 4.8 | 2.6 | 9.2 |

# YIELD MAXIMIZATION AND DETERMINATION FACTORS FOR HIGH YIELD OF MUNGBEAN


## Abstract

The experiment was conducted in farmers' field at FSRD site, Lebukhali, Patuakhali during late rabi, 2003 to maximize the yield of Mungbean and find out the contribution of each factor for high yield of Mungbean. The result of the experiment reveals that full package produces the highest grain yield. There was no statistical difference between good tillage and minimum tillage. Treatment without fertilizer and without weed control produces statistically identical yield. There was statistically difference between irrigation and without irrigation. Pest reduced yield drastically this year. Farmers' practice produced the lowest yield.


## Introduction

Mungbean is the major rabi crop grown in Patuakhali area. But Mungbean is grown in very low management practices, such as less tilth of land, without any fertilizer, weed and pest control and irrigation practices. As a result, yield of Mungbean is very low (300-500 kg/ha) and mostly depend of climatic condition, disease and insect infestation. Previous studies revealed that yield of Mungbean could be obtained up to 1.5 t/ha, which in return produces higher gross margin (net benefit) than cumulative gross margin of T.Aus and T.Aman rice, the major crops of the region. So, this trial will be conducted to give emphasis in cultivation of Mungbean with high management practices for maximum yield.

## Materials and methods

The experiment was conducted in farmers' field at FSRD site, Lebukhali, Patuakhali during late rabi, 2003. Mungbean variety used was BARI Mung-5. The experiment was laid out in RBC design with five dispersed replications. Seven treatments were used with different management packages were as follows:

$T_1$= Full package of recommended management practices (a. Good tillage, 4-5 ploughing and laddering, b. Recommendation fertilizer for NPK, c. Weed control, 1-2 weeding, d. irrigation, 1-2 times and e. pest control.)
$T_2$= Full package without good tillage.
$T_3$= Full package without recommended fertilizer.
$T_4$= Full package without weed control.
$T_5$= Full package without irrigation.
$T_6$= Full package without pest control.
$T_7$= Farmers' practice (2 ploughing, no fertilizer, weed control, irrigation and pest control).

The unit plot size was 8m x 5m. Mungbean seeds (35 kg/ha) were sown on 2 February, 2003 in line sowing (line to line distance 30 cm). 12-8-8 kg/ha NPK was applied during final land preparation. Weed control was done once after 20 days of sowing. Irrigation was done once after 25 days of sowing. First shower of the season began on March 14, 2003. Severe infestation of thrips occurred at the time of first flowering and also pod borer infestation was severe. Cymbush @ 2 ml/liter water was sprayed at the time of first flowering. The treatment without pest control gave zero yield at first time. After harvesting first time inflorescence appeared 2$^{nd}$ time and a good yield obtained.

## Result and Discussion

The result of the experiment reveals that full package produces the highest grain yield but there was no statistical difference between good tillage and minimum tillage. Treatment without fertilizer and without weed control produces statistically identical yield. There was statistically difference between irrigation and without irrigation. Pest reduced yield drastically this year. Farmers' practice produced the lowest yield.

As it was the result of one year experiment, it should be continued for the next year.

Table1. Yield and yield contributing characters of Mungbean under different management practice

| Treatment | Plant height (cm) | Plant population at harvest | Branch/ plant | Pod/ plant | Seed/ pod | 1000seed wt. (gm) | Yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 40a | 32ab | 4.5ab | 16.2a | 8.6 | 32.2a | 1356a |
| $T_2$ | 38b | 33a | 4.6a | 16.4a | 8.2 | 30.6b | 1300a |
| $T_3$ | 39ab | 32ab | 3.8abc | 15.4ab | 8.2 | 30.8b | 1190b |
| $T_4$ | 40a | 31bc | 3.2c | 15.5ab | 8.2 | 30.2b | 1136b |
| $T_5$ | 40a | 31bc | 3.6bc | 13.8b | 7.6 | 30.2b | 964c |
| $T_6$ | 40a | 32ab | 2.0d | 5.2c | 8.0 | 30.2b | 388d |
| $T_7$ | 38b | 30c | 3.3c | 4.1d | 8.0 | 30.2b | 296e |
| CV (%) | 4.45 | 3.24 | 13.90 | 7.89 | 12.78 | 1.61 | 10.20 |

# ON-FARM ADAPTIVE TRIAL OF DEVELOPED AND ADVANCED LINES OF GROUNDNUT IN SALINE AREA OF NOAKHALI


## Abstract

Three years field experiment were conducted in the farmers' field of FSRD site Atkapalia, Noakhali during the Rabi season of 2000-01, 2001-02 and 2002-03 with two developed varieties (BARI Badam-5 and BARI Badam-6) along with an advanced line ICGS89257 and local variety. Three years result showed that BARI Badam-6/5 performed better in respect of nut yield and recommended for cultivation in saline area of Noakhali.


## Introduction

Most of the farmers of the 'char' area cultivate local variety of groundnut with traditional management practices resulting very low yield. Oilseed Research Center of BARI already developed some variety and one promising line of groundnut on the basis of their yield performance. This variety/line needs to be tested to evaluate the performance of some varieties of groundnut under farmers' condition.

## Materials and Methods

The study was conducted at FSRD site Atkapalia, Noakhali during Rabi season of 2000-01, 2001-02 and 2002-03. The experiment was laid out in RCB design with four replications. The soil was silty loam to clay under the Ramgoti soil series of AEZ 18. Unit plot size was 5 m x 4 m. Fertilizer dose of 10-70-50 kg/ha of NPK, respectively, was applied in the form of Urea, TSP and MP. All fertilizers were applied as basal dose during final land preparation. Seeds were sown in lines maintaining 30 cm x15 cm spacing. A few root rot diseases were observed. Harvesting was done from mid to last of May.

## Results and Discussion

Yield and yield attributes were presented the Table 1. Yield and yield attributes differed significantly among the varieties/lines. The highest plant height was found from ICGS89257 in 2001-02 but this line showed similar height with BARI Badam 5 & 6. Branches/plant was identical except local, which showed the lowest height and branches/plant. The highest pods/plant was recorded from the local variety but at par to ICGS89257. In respect of 100 kernel weight, BARI Badam-6 and respective line showed statistically similar and higher performance than local and BARI Badam-5. Higher nut yield was recorded from BARI Badam-5 (2.9 t/ha) which was statistically similar to BARI Badam-6 (2.97 t/ha) and ICGS89257 (2.87 t/ha). On an average, higher nut yield was obtained from BARI Badam-6 followed by BARI Badam-5, which was much higher yield than local variety. It was concluded from the result that BARI Badam-6/5 could be grown for higher yield in saline area of Noakhali.

Table 1. Performance of different groundnut varieties/line in saline area of Noakhali (Average of 3 years results)

| Variety/line | Plant height (cm) | Branch/ plant (no.) | Pod/ plant | 100-kernal weight (g) | Nut yield (t/ha) | | | Average nut yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2000-01 | 2001-02 | 2002-03 | |
| BARI Badam-5 | 45.78 | 8.55 | 26 | 49.28 | 2.87 | 2.81 | 2.92 | 2.87 |
| BARI Badam-6 | 43.14 | 8.20 | 24 | 53.71 | 2.93 | 2.86 | 2.91 | 2.90 |
| ICGS89259 | 41.34 | 8.15 | 29 | 52.70 | 2.50 | 2.94 | 2.87 | 2.77 |
| Local | 41.53 | 5.93 | 31 | 37.05 | 2.32 | 2.59 | 2.58 | 2.50 |
| LSD (0.05) | 3.34 | 1.54 | 4.39 | 1.03 | 0.60 | NS | 0.14 | - |
| CV (%) | 4.87 | 12.52 | 9.89 | 1.34 | 11.30 | 14.59 | 3.20 | - |

# SECONDARY YIELD TRIAL OF BARLEY FOR SALINE AREA


## Abstract

The trial was conducted with three selected lines viz. BSHL-2, BSHL-4 and BSH-32 along with a variety BARI barley-4 at the farmers' field of FSRD site Atkapalia, Noakhali, Paikgacha, Khulna and Kalapara, Patuakhali during the rabi season of 2001-03 to select and evaluate their yield potentiality and adaptability in saline area. On an average, the highest grain yield (1068 kg/ha) was recorded from BSH-32 at Noakhali whereas BSHL-4 at Khulna in 2001-02 and BBL94/331 in 2002-03 but BSH-2 at Patuakhali in 2002-03 but average of two years BSH-32 performed better.


## Introduction

Barley is one of the important cereals of the world. In Bangladesh barley is cultivated as minor cereal. It can be grown in less fertile soil with minimum inputs. Barley is grown as food for poor people. In foreign country barley is used in a beverage industry for processing alcohol and wine. It is known that barley is a salt tolerant crop. In coastal area, vast land remains fallow due to salinity in rabi and early kharif season. Barley may be cultivated in saline area. BARI has recently developed some high yielding barley variety/lines. The performance of these variety/lines needs to be evaluated in saline area at farmers' field. Keeping this in mind the trial was undertaken.

## Materials and Methods

The experiment was conducted under rainfed condition at the farmers' field of FSRD site, Atkapalia, Noakhali, MLT site Paikgacha, Khulna and Kalapara, Patuakhali during the rabi season of 2001-03. Three lines of barley viz. BSHL-2, BSHL-4 and BSH-32 were compared with a variety BARI barley-4 in 2001-02 but the more lines (BBL94/331, BSH-1 and BB-4) were included at Khulna in 2002-03. The former three lines were hull less. The experiment was laid out in a RCB design with three replications. The plot size was 18 $m^2$. Fertilizer @ 100-60-40 kg of NPK/ha was applied as basal during the final land preparation. The seeds were sown in line with 30 cm spacing with seed rate 100 kg/ha on 6 December, 2001 and 2002 at Noakhali, 24 December in 2001 & 23 November 2002 at Khulna and 10 December at Patuakhali. Sevin dust was applied with molasses to control cut worm at the seedling stage. Hinosan (0.02%) was sprayed twice 10 days intervals at pre-flowering stage during the just appearance of blight. Weeding was done twice. The crops were harvested 1st week of March in both the years at Noakhali, 1st week of April in 2001-02 & 3rd week of March in 2002-03 at Khulna and 4 April at Patuakhali. In 2001-02. Initial salinity of field was 0.58 ds/m and during the study period the salinity was up to 4.36 ds/m. But salinity level increased up to 5.0 ds/m in 2002-03. The data on yield attributes were statistically analyzed by MSTAT and the means were separated by LSD. The soil salinity level at Khulna site during 24 Dec., 10 and 25 January, 10 & 20 Feb. 1, 10 & 25 March and 5 April were 2.03, 7.71, 6.45, 15.93, 15.80, 8.07, 11.21, 8.10 and 5.20 mm hos/cm, respectively, in 2001-02 but varied in 2002-03 in 23 November, 7 & 22 December, 7 & 22 January, 8 & 24 February, 8 & 18 March 2003 were 1.81, 2.03, 1.94, 3.31, 4.45, 5.68, 5.13, 5.9 & 6.14, mm hos/cm, respectively, whereas soil salinity at Patuakhali site during Dec. 1, Dec. 15, Dec. 30, Jan. 15, Jan. 30, Feb. 15, March 3, March 16 and March 30 were 3.95, 4.21, 5.60, 7.50, 8.75, 11.05, 12.91, 13.88 and 15.27, respectively.

## Results and Discussion

### Site: Noakhali

Yield and yield attributes of Barley lines along with a variety are presented in Table 1. Plant height and number of effective tillers per plant did not differ significantly. Germination percentage was higher is BSHL-32 but statistically identical to all the varieties/lines. The length of spike of different line was statistically at par but BSHL-2 showed the lowest spike length. The line BB-4 showed higher no. of grains/spike but statistically identical to all variety/line except BSHL-4. The highest grain yield was obtained from line BSHL-4 but statistically identical. On an average, the highest grain yield (1068 kg/ha) was obtained from BSH-32. The yield level in 2001-02 was much higher than this year which might be due to low soil salinity level. Straw yield showed similar behaved as in grain yield. Ayers and Westcost (1976) reported that most arable crop can withstand salinity not exceeding 4.5 ds/m without significant reduction in yield. Soil salinity is the most dominant factor, which limits crop productivity particularly in the rabi and kharif-I seasons (Karim *et. al*., 1990).

**Site: Khulna**

Plant height, spike/m$^2$, length of spike, grains/spike, 1000-grain weight and grain yield was significantly influenced by different line/variety (Table 2). The line BL-1 showed the highest spike/m$^2$ which was statistically identical to BB-4. Length of spike gave higher from line BBL94/331 but at par to all line except BL-1. The highest grains/spike revealed from line BBL94/331 but statically identical to BSHL-4. Significantly the highest grain weight was recorded BBL94/331. Significantly the highest grain yield was recorded from line BBL94/331 due to higher grain weight.

**Site: Kalapara, Patuakhali**

Statistical analysis was not done at the site. But germination (%) was the highest from BSH-2. The line BSH-2 showed the highest plant height, length of spike and grains/spike. The effective tiller was almost similar in BSH-32 and BSH-2. The line BSH-2 showed the highest grain yield in 2002-03 but this line was not included in 2001-02. On an average, the highest yield was recorded from line BSH-32.

From the study it was observed that BSH-32 line performed better in the saline area of Noakhali but line BBL94/331 at Khulna and BSH-2 at Patuakhali. The experiment should be repeated another year for confirmation at Khulna and Patuakhali because variety/line changed in 2002-03.

**References**

Ayers, R. S. and D. W. Westcot. 1976. Water quality for agriculture, Irrigation and Drainage Paper 29, F. A. O. Rome.

Karim, Z., Hussain, S. G., and M. Ahmed. 1990. Salinity problems and crop intensification in the coastal regions of Bangladesh. BARC Soil publication no. 33: page 63.

Table 1. Yield and yield attributes of Barley at the FSRD site, Atkapalia, Noakhali during rabi 2002-03

| Lines/ Variety | Germination (%) | Plant height (cm) | Effective tillers/ plant (no.) | Spike length (cm) | Grains / spike (no.) | Grain yield (kg/ha) | | Straw yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 | |
| BSHL-2 | 80 | 59.80a | 3.07b | 5.47 | 30 | 1056 | 803 | 926 |
| BSHL-4 | 82 | 52.73b | 4.40a | 7.00 | 26 | 1028 | 860 | 920 |
| BSH-32 | 83 | 50.53b | 3.93ab | 6.60 | 31 | 1333 | 803 | 933 |
| BB-4 | 78 | 49.80b | 2.93b | 5.93 | 34 | 1167 | 750 | 850 |
| LSD(0.05) | NS | 6.37 | 0.27 | NS | 7.0 | 148.1 | NS | NS |
| CV (%) | 3.21 | 5.99 | 14.38 | 14.63 | 12.26 | 6.47 | 9.96 | 9.12 |

Figure in column having similar letter(s) do not differ significantly

Table 2. Yield and yield attributes of barley as affected by different lines/variety at Paikgacha MLT site during 2002-03

| Line/ Variety | Days to maturity | Plant height (cm.) | Spike/m$^2$ (no.) | Grains/ spike (no.) | 1000-grain weight (g.) | Grain yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 |
| BSHL-2 | - | - | - | - | - | 954b | - |
| BSHL-4 | 106 | 71.13bc | 192c | 25ab | 24.00c | 1007a | 1180c |
| BSH-32 | 106 | 78.71ab | 221b | 23b | 20.33d | 912d | 1040cd |
| BB-4 | 105 | 69.56c | 247a | 18cd | 18.00c | 924c | 950d |
| BBL94/331 | 108 | 80.00a | 222b | 29a | 34.00a | - | 2200a |
| BL-1 | 105 | 68.13c | 257a | 22bc | 28.00b | - | 1350b |
| BB-1 | 106 | 80.90a | 195c | 18cd | 18.00c | - | 950d |
| CV (%) | - | 5.84 | 4.44 | 10.64 | 4.96 | 10.0 | 6.68 |

Table 3. Yield and yield attributes of Barley as influenced by different line/variety at Kalapara, Patuakhali during 2002-03

| Line/ Variety | Germination (%) | Plant height (cm.) | Length of spike (cm) | Grains/ spike (no.) | Effective tiller/hill | Grain yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 |
| BSH-32 | 80 | 66.43 | 5.8 | 39 | 4.6 | 1720 | 1721 |
| BSHL-2 | 78 | 55.83 | 4.8 | 33 | 3.9 | 1497 | 578 |
| BSHL-4 | 78 | 54.90 | 5.2 | 38 | 4.4 | 677 | 914 |
| BB-4 | 77 | 70.27 | 7.2 | 49 | 4.2 | 837 | 1010 |
| BSH-2 | 88 | 72.13 | 6.4 | 44 | 4.6 | - | 2023 |
| BBL-94/331 | 70 | 62.40 | 5.0 | 32 | 4.0 | - | 447 |

# ADAPTABILITY TRIAL OF WHEAT IN SALINE AREA UNDER LATE SOWN CONDITION


## Abstract

On-farm performance of five wheat varieties namely Kanchan, Sourav, Gourab, Protiva and Shatabdi were evaluated at Paikgacha MLT site, Khulna. On an average, Sourav produced higher grain yield followed by Kanchan. Protiva produced the lowest grain yield. The variety Sourav could be grown in Fallow-Fallow- Fallow or Fallow-T.Aman- Fallow cropping pattern in saline area.


## Introduction

Wheat (*Triticum aestivum*) is the second important cereal crop in Bangladesh. Its cultivation has dramatically been increased during the last few years. Most of the lands in saline area remain fallow in winter season due to salinity. Recently study showed that wheat can survive and performed better up to medium level of salinity. Recently BARI has developed few high yielding varieties more tolerant to leaf rust disease. After late harvesting of T.Aman the land remain fallow due to salinity. So, an experiment was undertaken to test the performance of newly released wheat varieties in saline area under late sown condition.

## Materials and Methods

The trial was initiated at Paikgacha MLT site during Rabi season, 2001-02 and 2002-03 with five wheat varieties namely Sourav, Gourab, Kanchan, Protiva and Shatabdi flowing RCB design with four replications in farmers' field. The unit plot size was 3 m x 2 m. The crop was sown on 24 December, 2001 and last week of November 2002 in line sowing. Line to line spacing was 20 cm. Fertilizer were applied at the rate of 100-60-30 kg/ha of N-$P_2O_5$-$k_2O$, respectively. All TSP, MP and urea were applied as basal. All the intercultural operations were done as and when necessary. The crop was harvested during the last week of March, 2002 and 3rd week of March 2003. Data on yield and yield attributes were collected and analyzed statistically. The soil salinity level during the crop growing periods measured. The salinity level at the site during 24 Dec., 10 & 25 May, 1 & 30 Feb., 1, 10, 25 March & 5 April were 2.03, 7.71, 6.45, 15.93, 15.80, 8.02, 11.21, 8.10 & 5.20 mm hos/cm, respectively but during 2002-03, were 1.81, 2.03, 1.34, 3.31, 4.45, 5.68, 5.13, 5.9 and 6.14 mm hos/cm, respectively in 23 Nov., 7 & 22 Dec., 7 & 22 Jan., 8 & 24 Feb., 8 & 18 March, respectively.

## Results and Discussion

Only length of spike and grain yields was significantly affected by different varieties. Gourav showed the highest plant height but insignificant. Spike/m$^2$ was statistically identical but higher from Kanchan. The variety Kanchan revealed higher grain/spike than other variety. Similar behave in 1000-grain weight. All the variety performed better yield but higher yield was obtained from Kanchan followed by Sourav. On an average of two years result showed that Sourav better performance in respect of yield in saline area of Khulna but it needs further trial for confirmation.

Table 1. Yield and Yield attributes of wheat as affected by different varieties at Paikgacha MLT site during 2002-03

| Variety | Days to maturity | Plant height (cm) | Spike/ m$^2$ (no.) | Grain/ spike (no.) | 1000 grain weight (g) | Grain yield (t/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 |
| Shatabdi | 107 | 89 | 10.67a | 36 | 35.30 | 0.95bc | 2.30ab |
| Sourav | 105 | 88 | 9.50b | 31 | 36.16 | 1.23a | 2.34a |
| Gourab | 105 | 92 | 10.53a | 35 | 36.20 | 0.95bc | 2.11ab |
| Protiva | 103 | 87 | 8.90b | 33 | 35.30 | 0.89a | 1.98b |
| Kanchan | 103 | 90 | 10.73a | 39 | 37.20 | 1.10ab | 2.42a |
| CV (%) | - | 4.20 | 3.26 | 10.12 | 3.07 | 10.42 | 7.43 |

Means followed by common letters are statistically similar at 5% level.

# ON-FARM EVALUATION TRIAL OF SWEET POTATO VARIETIES


## Abstract

On farm evaluation trial of different Sweet potato varieties was carried out at FSRD site, Atkapalia, Noakhali during the Rabi season of 2001-03.The result revealed that BARI SP-4 gave the highest yield (23 t/ha) followed by Tripti (20.81 t/ha) and BARI SP-4( 20.01 t/ha). The lowest yield was found from local variety (14.50 t/ha). The highest BCR (2.93) was found from BARI SP-4 and the lowest in BARI SP-5.


## Introduction

Sweet potato grows well in char area of Noakhali district but yield is very low due to cultivation of local variety. Recently BARI has developed some new varieties of sweet potato. So, an experiment was undertaken to identify suitable variety for char area of Noakhali.

## Materials and Methods

The experiment was conducted at FSRD site, Atkapalia, Noakhali during 2001-03. There were six varieties Tripti, Daulatpuri, Kamalasunduri, BARI sweet potato-4, BARI sweet potato-5 and Local in the study. The experiment was laid out RCBD with 3 dispersed replication. The unit plot size was 8m x 5m. Row to row and plant to plant spacing was 60 cm x 30 cm. Fertilizer dose 114-92-58 NPK kg/ha were used as basal dose. The crop was sown on 14 December 2001 and 1st January 2003 and harvested 11-12 May 2002 and 4-10 May 2003. Data were statistically analyzed.

## Results and Discussion

Yield and yield performance as well as cost benefit analysis are presented in Table 1. Higher number of root/plant was found from BARI SP-5 which was statistically similar to Daulatpuri & Tripti. The root weight per plant was found high in BARI SP-4 but at par with Tripti. On an average, maximum yield was found from BARI SP-4 followed by Tripti. The lowest yield was found from local variety in both the years.

The highest gross margin and benefit cost ratio was obtained from BARI SP-4. BARI SP -4 could be grown in saline area of Noakhali for its high yield.

### Farmers' reaction

BARI developed varieties of sweet potatoes are new in the FSRD site, Atkapalia, Noakhali and its market price lower than local variety. Farmers' attitude about Kamalasunduri is well for attractive colour, sweetness and softness. But local variety can be stored for longer time than the BARI developed variety. Though, the local variety gave the lowest yield but acceptance more due to higher price and keeping quality.

Table 1. Yield, yield attributes and cost benefit (average) analysis of different sweet potato varieties at Atkapalia, Noakhali during 2002-03

| Variety | Root/ plant | Root wt. /plant (g) | Yield (t/ha) | | Gross return | TVC | BCR | |
|---|---|---|---|---|---|---|---|---|
| | | | 2001-02 | 2002-03 | | | 2001-02 | 2002-03 |
| Tripti | 4.6b | 672ab | 17.96a | 23.67 | 62440 | 23500 | 2.29 | 3.02 |
| Daulatpuri | 4.97ab | 551c | 12.43b | 21.67 | 51145 | 23500 | 1.59 | 2.76 |
| Kamalasundari | - | - | 17.22a | - | 51660 | 23500 | 2.19 | - |
| BARI SP- 4 | 4.4bc | 735a | 20.01a | 26.00 | 69015 | 23500 | 2.55 | 3.31 |
| BARI SP-5 | 5.5a | 596bc | 12.59b | 20.33 | 49380 | 23500 | 1.61 | 2.59 |
| Local | 3.67c | 557c | 10.34b | 18.67 | 48685 | 23500 | 1.80 | 2.44 |
| LSD | 0.861 | 82.83 | 4.509 | NS | | | | |
| CV (%) | 9.19 | 7.07 | 16.42 | 18.61 | | | | |

# ON-FARM TRIAL OF TOMATO VARIETIES


## Abstract

Performance of four tomato varieties namely BARI tomato-6, BARI tomato-7, BARI tomato-8 and BARI tomato-11 were evaluated in saline belt of FSRD site, Atkapalia, Noakhali during 2001-02 and 2002-03. The variety, BARI tomato-7 gave the highest yield (65.14 t/ha) followed BARI Tomato-8 (62.67 t/ha). The highest gross margin (Tk. 260580/ha) and benefit cost ratio (5.30) was recorded in BARI tomato-7 due to it's the higher yield performance.


## Introduction

Tomato is not common and popular vegetables in Bangladesh. It is rich in Vitamin. The average yield of local variety is very low compared to release varieties of BARI. The low yield in Noakhali district is due to use of local variety and salinity effect. Therefore, the experiment was taken in order to determine the adaptability and yield performance of newly developed tomato varieties in the farmers' field.

## Materials and Methods

Four developed varieties of tomato by BARI viz., BARI tomato-6, BARI tomato-7, BARI tomato-8 and BARI tomato-11 were evaluated at FSRD site, Atkapalia, Noakhali during the Rabi season of 2001-02 and 2002-03. The experiment was laid out in RCB design with six dispersed replications. The unit plot size was 40 $m^2$.Seedlings were transplanted from 25 November to 24 December, 2001 & 1$^{st}$ week of November to last week of December 2002 with 60 cm x 40 cm spacing recommended dose of fertilizers were applied as basal during the final land preparation. The plots were weeded in two times. Harvesting was done from 4 March to 9 April, 2002 and Mid February to Mid April 2003 depending upon the maturity condition of fruits. Data on yield and yield contributing characters were recorded and analyzed. Moreover, input and output prices were recorded for cost and return analysis.

## Results and Discussion

Response of tomato varieties about yield and yield contributing character is presented in Table 1. The varieties differed signi1ficantly fruit weight and yield. Significantly the highest individual fruit weight was recorded in BARI tomato-7 and the lowest from BARI Tomato-12. BARI Tomato-7 gave high yield which was statistically similar with BARI Tomato-8 and BARI Tomato-2. The highest yield was due to their individual fruit weight. The lowest yield was recorded in BARI Tomato-6. The variety BARI Tomato-1 gave the highest gross margin followed by BARI Tomato-2 and BARI Tomato-8. But higher benefit cost ratio was recorded from BARI Tomato-7 followed by BARI Tomato-8.

## Conclusion

The production of tomato during rabi season, 2001-02 at Atkapalia, Noakhali was found satisfactory but decline during 2002-03.

### Farmers' reaction

Farmers were very much pleased due to high yield performance. BARI tomato-8 was more popular for its long durability. Farmers already preserved the seeds of the BARI tomato -8 for next year cultivation.

Table 1. Yield, yield attributes and cost benefit analysis (average) of Tomato at FSRD site, Atkapalia, Noakhali during 2002-03

| Treatment | Fruits/ plant (no.) | Each fruit weight (g) | Yield (t/ha) | | TVC (Tk./ha) | GR (Tk./ha) | BCR | |
|---|---|---|---|---|---|---|---|---|
| | | | 2001-02 | 2002-03 | | | 2001-02 | 2002-03 |
| BARI Tomato-2 | 25 | 83.17c | 63.31b | - | 60400 | 253240 | - | 4.19 |
| BARI Tomato-6 | 23 | 88.90bc | 61.37b | 46.06a | 49400 | 214860 | 4.79 | 4.06 |
| BARI Tomato-7 | 23 | 112.2a | 76.62a | 53.61a | 49400 | 260580 | 5.59 | 5.02 |
| BARI Tomato-8 | 25 | 101.8bc | 76.01ab | 69.33a | 49400 | 250680 | 5.13 | 5.03 |
| BARI Tomato-11 | - | - | - | 20.37a | 38400 | 61110 | 1.59 | - |
| LSD (0.05) | NS | 12.95 | - | 8.23 | | | | |
| CV (%) | 6.89 | 6.73 | - | 15.82 | | | | |

Figures in column having similar letter do not differ significantly.

## SCREENING OF DIFFERENT RABI CROPS IN SALINE AREA


### Abstract

An attempt was made to identify suitable crops for saline area of MLT site Kalapara, Patuakhali during the season of 2001-02. Salinity level in the area ranges between 6-14 ds/m during the dry period. Chilli, Mungbean, sesame, linseed, cowpea, sunflower and safflower were grown as test crop. Among those crops, Chilli, sunflower, sesame and cowpea were found feasible and profitable in both irrigated and rainfed condition.


### Introduction

At present total saline area of the country is estimated to be about 0.88 million ha of which more than 0.22 million ha is in Patuakhali region. These lands are affected by salinity of varying degrees from 5-26 ds/m during dry period. Present land use in the coastal area is primarily limited within growing of T.Aman rice crop in the wet season. During dry period (Nov.-March) a vast area of land remains fallow due to salinity and farmers' are not known about crops/variety to be grown in the site. In this context an experiment was undertaken to find out the suitable crops in the saline area.

### Materials and Methods

The experiment was conducted at MLT site Kalapara, Patuakhali during rabi 2001-02. The experiment was laid out in randomized complete block design with 4 replications. The unit plot size was 6m x 5m. Seven crops were selected viz., Mungbean, cowpea, sunflower, safflower, linseed, sesame and Chilli. Crops were cultivated in rainfed and irrigated condition. The salinity level of water at the site during 2002-03 in January, February and March were 0.53, 0.59 and 0.64 ds/m and soil moisture (0-15 cm depth) in January, February, March and April were 21.4, 14.4, 12.63 and 18.0 ds/m, respectively.

Spacing, fertilizer, sowing and harvesting time of different crops shown below, 2002-03:

| Crops | Variety | Spacing (cm) | NPK (kg/ha) | Sowing time | Harvesting time |
|---|---|---|---|---|---|
| Chilli | Local | 50 x 30 | 50-30-50 | Dec. 14, 2002 | May15, 2003 |
| Mungbean | Kanti | 30 x 5 | 8-6-8 | Jan. 5, 2003 | April 20, 2003 |
| Sunflower | Kironi | 50 x 25 | 92-40-60 | Dec. 15, 2002 | April 15, 2003 |
| Sesame | T-6 | 30 x 5 | 45-20-24 | Dec. 20, 2002 | May 15, 2003 |
| Cowpea | BARI Felon | 40 x 15 | 8-14-18 | Dec. 20, 2002 | April 20, 2003 |
| Linseed | Nila | 30 x 10 | 45-20-24 | Dec. 15, 2002 | April 17, 2003 |

### Results and Discussion

Seven crops were evaluated in the saline area of Kalapara, Patuakhali of which Chilli performed better with higher benefit cost ratio in both irrigated and rainfed condition. Although Chilli involved higher cost of cultivation but due to its market price higher gross return was achieved. Among two pulses crops, cowpea was found better than Mungbean in respect of yield and benefit. Four oilseed crops were put under trial of which sunflower showed higher yield and monetary benefit than other three crops in both situation. From above result it showed that Chilli, cowpea and sunflower could be grown in saline area of Patuakhali region.

Table 1. Salinity level (ds/m) at different depth of soil at Kalapara, Patuakhali during rabi 2002-03

| Month | Top soil | 10 cm | 20 cm | 30 cm |
|---|---|---|---|---|
| December | 8.17 | 7.40 | 7.0 | 6.9 |
| January | 7.90 | 7.60 | 6.89 | 7.41 |
| February | 10.00 | 10.00 | 8.90 | 8.30 |
| March | 15.50 | 12.00 | 10.63 | 10.52 |
| April | 13.00 | 10.56 | 10.46 | 10.30 |

Table 2. Yield and BCR of Mungbean, Chilli, Cowpea and Sesame in irrigated condition at Kalapara during Rabi 2001-02 & 2002-03

| Crops | Yield (kg/ha) | | | BCR | |
|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Mean | 2001-02 | 2002-03 |
| Chilli | 740 | 740 | 740 | 2.12 | 2.74 |
| Cowpea | 1292 | 1300 | 1296 | 1.48 | 1.38 |
| Mungbean | 490 | 416 | 453 | 1.40 | 1.19 |
| Sesame | 1090 | 853 | 971.5 | 1.42 | 1.11 |
| Sunflower | 1267 | 1260 | 1263.5 | 1.64 | 1.63 |
| Linseed | 800 | 760 | 780 | 1.43 | 1.26 |
| Safflower | 1167 | - | 1167 | 1.52 | - |

Table 3. Yield and BCR of Mungbean, Chilli, Cowpea and Sesame in rainfed condition at Kalapara during Rabi 2001-02 & 2002-03

| Crops | Yield (kg/ha) | | | BCR | |
|---|---|---|---|---|---|
| | 2001-02 | 2002-03 | Mean | 2001-02 | 2002-03 |
| Chilli | 1096 | 616 | 856 | 1.36 | 2.27 |
| Cowpea | 578 | 1110 | 844 | 1.65 | 1.28 |
| Mungbean | 420 | 398 | 409 | 1.20 | 1.30 |
| Sesame | 986 | 756 | 871 | 1.28 | 1.10 |
| Sunflower | 1007 | 1053 | 1030 | 1.30 | 1.53 |
| Linseed | 700 | 662 | 681 | 1.16 | 1.26 |
| Safflower | 900 | - | 900 | 1.17 | - |

**Crops (Tk./kg):** Mungbean=23, Linseed= 12, Cowpea=13, Chilli=35, Sesame= 2, Sunflower=12, Safflower=12

# CROP SCREENING AFTER T.AMAN RICE HARVEST


## Abstract

An experiment was deigned to identify crops in the Patuakhali area after T.Aman harvest during rabi season of 2002-03 at FSRD site Lebukhali, Patuakhali. The experiment was firstly initiated in all three phases of Medium highland. In lower phase only local varieties of T.Aman rice is grown which harvest late usually in last of December to mid January. Any rabi crops grown in the lower phase was not found more profitable in compare to Mungbean. In the ridge almost all rabi crops of the experiment could be grown successfully and profitably. So in this current year the experiment was conducted only in the medium phase of medium high land. The experiment was conducted with 7 crops on medium high land (Ridge) modern and Local varieties of rice where harvested with in 30 November. All the crops grown were found promising of which onion showed the highest benefit cost ratio (5.56). On an average, Brinjal showed the highest BCR (7.10) during 2002-03 but Brinjal was not included in 2001-02.


## Introduction

The entire district of Patuakhali and Barguna is within the Ganges Tidal Floodplain (AEZ-13). Most of the lands of this zone get tidally flooded from end of March to end of November. More than 60% of all the cultivable land of this area remains fallow during winter. Only a limited number of crops like khesari, Cowpea, Mungbean, Chilli, Sweet Potato, G. Nut etc. are grown in about one third of the crop land due to late harvest of T.Aman rice. Though major part of the area is of medium highland type there are variations in the flooding depth of the cropland varies from 15cm to 80cm. Depending upon flooding depth medium highland are divided into 3 phases namely ridge (6-30 cm) medium phase (30-60 cm) and lower phase(70 cm above). Modern and local varieties of rice are grown depending upon flooding depth. So, an experiment was designed to identify crops those could be grown profitability in medium high land ridge (flooding depth 15 to 30 cm).

## Materials and Methods

The experiment was conducted in medium highland at Farming Systems Research and Development (FSRD) site Lebukhali, Patuakhali during the year rabi 2001-02 and 2002-03 to find out the profitable crop production after T.Aman rice harvest in rainfed condition. The study was made as in RCB design with 5 replications. Each unit plot measured 6 m x 5 m. T.Aman rice was harvested on 30 November. Five crops viz. Chilli, Mungbean, Onion, Sesame, Chickpea were grown in 2001-02 but during 2002-03 more few crops like Brinjal, Tomato, Potato and Sweet potato were included.

## Results and Discussion

Yield of Chilli, Mungbean, onion, sesame and chickpea were similar in both the years but higher BCR was recorded from onion. During 2002-03 few more crops were included. Among which brinjal showed the highest yield and BCR (7.10) followed by onion. Mungbean also showed reasonable yield and BCR. The experiment needs further trial because new crops were included in 2002-03.

Table 1. Management practice of different crops grown for the experiment, 2002-03

| Variety | Variety | Spacing (cm) | Fertilizer NPK (kg/ha) | Sowing time | Harvesting time |
|---|---|---|---|---|---|
| Chilli | Local | 50 x 30 | 50-30-50 | December, 2002 | May 20, 2003 |
| Mungbean | BARI Mung-5 | 30 x 5 | 8-6-8 | January 27, 2003 | April 26, 2003 |
| Onion | Taherpuri | 30 x 15 | 121-40-70 | December 29, 2002 | April 19, 2003 |
| Chickpea | Local | 30 x 10 | 15-14-15 | December 12, 2002 | April 13, 2003 |
| Brinjal | Kazla | 60 x 40 | 150-30-125 | December 14, 2002 | March 29, 2003 |
| Sweet Potato | Tripti | 40 x 30 | 50-25-50 | December 24, 2002 | April 24, 2003 |
| Potato | Diamont | 40 x 30 | 135-40-135 | December 15, 2002 | March 4, 2003 |
| Tomato | BARI Tomato-6 | 60 x 40 | 250-90-125 | December 12, 2002 | April 10, 2003 |
| Pointed gourd | - | 40 x 30 | 150-30-125 | December 26, 2002 | damaged |

Table 2. Yield and BCR of different crops after T.Aman harvest in Patuakhali region

| Crops | Yield (kg/ha) | | BCR | |
|---|---|---|---|---|
| | 2001-02 | 2002-03 | 2001-02 | 2002-03 |
| Chilli | 960 | 960 | 2.03 | 2.03 |
| Mungbean | 1000 | 1230 | 2.36 | 2.07 |
| Onion | 8546 | 8360 | 5.52 | 5.60 |
| Sesame | 1200 | 1200 | 1.40 | 1.56 |
| Chickpea | 926 | 950 | 1.63 | 2.26 |
| Brinjal | - | 49500 | - | 7.10 |
| Sweet Potato | - | 37750 | - | 4.30 |
| Potato | - | 20100 | - | 3.55 |
| Tomato | - | 50700 | - | 3.91 |
| Pointed gourd | damaged | | - | - |

| Crops | Price (Tk./kg) |
|---|---|
| Mungbean | = 25.00 |
| Onion | = 12.00 |
| Chickpea | = 25.00 |
| Chilli | = 35.00 |
| Sesame | = 12.00 |

# SCREENING OF DIFFERENT OIL CROPS IN SALINE AREA DURING RABI SEASON


## Abstract

The experiment was conducted at Banerpota farm, Satkhira to screen the different salt tolerant varieties of different oilseed crops. The result showed that soybean variety Shohag, Linseed line McGregor, Niger variety Shova and Safflower variety Saf-1 and Groundnut variety Jhinga badam performed better at Banerpota farm. Sesame did not perform well.


## Introduction

In Bangladesh, more than 30% of the cultivable area is in the coast. Coastal areas are seriously affected by various degrees of salinity. After harvesting of T.Aman vast land remain fallow. During rabi season, the soil salinity levels increase through capillary movement. For higher salinity most of the rabi crops do not survive in the area. BARI recently developed many high yielding varieties of oilseed crops. The performance of the varieties of oilseeds needs to be evaluated in saline area. The present study was therefore, undertaken to find out the suitable varieties of oilseeds in saline area.

## Materials and Methods

The trial was conducted at Banerpota farm, Satkhira during rabi season 2002-2003. Five different crops were sown on 28 November, 2002 at Banerpota farm. Four varieties of Soybean (Galisom, Shohag, Bangladesh soybean-4 and BARI soybean-5), four varieties of Linseed (Lin-1, Dufferin, McGragor and JL-3), four varieties of Niger (Shova, Nawalpur, Acc-108 and Acc-104), three varieties of Sesame (BARI Til-2, BARI Til-3 and T-6) and one variety of Safflower (Saf-1) and four varieties of Groundnut (Dhaka-1, BARI badam-5, BARI badam-6 and Jhinga badam) were included in the study. The unit plot size was 2 m x 1 m. Seeds were sown in a RCB design with three replications. The seeds were sown as line sowing. Two irrigations were given. The detail particulars of materials and methods are presented in Table-1. Intercultural operations were followed as and when necessary. The soil salinity level at the site during 27 Nov'02, 12 Dec'02, 27 Dec.'02, 13 Jan'03, 28 Jan'03, 11 Feb'03, 26 Feb'03, 10 Mar'03, 25 Mar'03, 10 Apr'03, 26 Apr'03 and 10 May'03 were 1.74, 1.84, 1.99, 2.1, 2.4, 1.84, 2.65, 2.98, 3.04, 3.61,3.54 and 3.60 mm hos/cm, respectively. Sesame crop damaged in late January.

Table 1. Methods of sowing, spacing and fertilizer dose for different crops

| Name of crops | Method of sowing | Spacing | Fertilizer dose (kg/ha) | | | |
|---|---|---|---|---|---|---|
| | | | N | P | K | S |
| Soybean | Line | 30 cm | 25 | 35 | 55 | 18 |
| Linseed | Line | 30 cm | 35 | 25 | 23 | - |
| Niger | Line | 30 cm | 35 | 25 | 25 | - |
| Sesame | Line | 30 cm | 50 | 28 | 23 | 20 |
| Safflower | Line | 40 cm | 45 | 20 | 25 | - |
| Groundnut | Line | 30 cm | 12 | 32 | 43 | 54 |

## Results and Discussion

### Soybean

Performance of different oil crop varieties has been presented in table-2. Plant height, pod/plant, 1000-seed weight and seed yield of soybean differed significantly by varieties/line. Shohag produced the highest seed yield could be due to seed weight. Bangladesh soybean-4 produced the lowest yield followed BARI Soybean 5. The higher yield from Shohag could be due to the lowest seed weight.

**Linseed**

Plant population/m$^2$, plant height, capsule/plant, 1000-seed weight and seed yield of linseed differed significantly by variety/line. The highest seed yield produced by McGragor followed by Lin-1. The former variety gave higher yield could be due to maximum capsule/plant and seed weight.

**Niger**

Plant height, head/plant, 1000-seed weight and seed yield of niger differed significantly by varieties/line. Significantly the highest seed yield was produced from variety. Shova could be due to the highest head/plant and seed/head. Acc-108 produced the lowest yield could be due to minimum head/plant and seed weight.

**Safflower**

A Safflower variety Saf-1 was introduced which yielded 1840 kg/ha.

**Groundnut**

Pod/plant, seed/pod, 100 kernel weight and pod yield of groundnut differed significantly by varieties. Jhinga badam produced the highest pod yield followed by BARI Badam-6. The farmers variety gave higher yield could be due to maximum number of seed/pod. Dhaka-1 produced the lowest yield could be due to lower seed/pod and seed weight.

## Conclusion

It was observed that soybean variety Shohag, linseed line McGragor, niger variety Shova, safflower variety Saf-1 and groundnut variety Jhinga badam showed better adaptability. Further investigation in relation to management practices could be done to evaluate the performance of above mentioned crops.

Table 2.Yield and yield attributes of different oil crops tested at Banerpota farm during Rabi, 2002-03

**a) Soybean**

| Variety/line | Days to maturity | Plant pop./m$^2$ | Plant height (cm) | Pod/ plant | Seed/ pod | 100-seed wt. (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Galisom | 126 | 35.50 | 56.00b | 46.50a | 2.25 | 6.32b | 1560c |
| Shohag | 128 | 34.00 | 56.25b | 38.75b | 1.92 | 10.90a | 1595a |
| Bangladesh soybean-4 | 130 | 34.75 | 61.75a | 41.75b | 2.20 | 5.67c | 1471b |
| BARI soybean-5 | 128 | 33.75 | 60.50ab | 39.25b | 2.17 | 10.50a | 1537ab |
| Level of significance | - | NS | * | * | NS | * | * |
| CV ( %) | - | 7.00 | 5.13 | 6.97 | 8.51 | 3.95 | 2.95 |

**b) Linseed**

| Variety/line | Days to maturity | Plant pop./m$^2$ | Plant height (cm) | Capsule/ plant | Seed/ Capsule | 1000-seed wt. (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Lin-1 | 125 | 116 b | 68.33c | 47.00c | 9.00 | 3.97a | 1483a |
| Dufferin | 131 | 135 a | 96.00a | 62.67a | 7.00 | 3.53b | 980c |
| McGragor | 133 | 116 b | 41.00d | 71.67a | 7.33 | 3.60b | 1511a |
| JL-3 | 131 | 149 a | 88.66b | 64.33ab | 7.33 | 3.47b | 1268b |
| LSD | | * | * | * | NS | * | * |
| CV (%) | | 6.43 | 4.67 | 6.30 | 13.22 | 4.46 | 2.89 |

**c) Niger**

| Variety/line | Days to maturity | Plant pop./m$^2$ | Plant height (cm) | Head/plant | Seed/head | 1000-seed wt. (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Shova | 113 | 34.25 | 107.75a | 47.00a | 33.00 | 3.42a | 1232a |
| Nawalpur | 110 | 34.25 | 92.25b | 36.75b | 28.00 | 3.55a | 1125b |
| Acc-104 | 113 | 32.50 | 104.25a | 37.00b | 31.75 | 3.37a | 1140b |
| Acc-108 | 113 | 35.25 | 104.50a | 36.25b | 32.00 | 3.10b | 1045c |
| LS | - | NS | * | * | NS | * | * |
| CV (%) | - | 5.18 | 4.43 | 7.11 | 9.35 | 5.03 | 3.24 |

**d) Safflower**

| Variety | Days to maturity | Plant pop./m$^2$ | Plant height (cm) | Head/plant | Seed/ head | 1000-seed wt. (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Saf-1 | 133 | 32 | 70 | 82 | 28 | 27.70 | 1840 |

**e) Groundnut**

| Variety | Days to maturity | Plant height (cm) | Pod/plant | Seed/ Pod | 100-kernel wt. (g) | Pod yield (kg/ha) |
|---|---|---|---|---|---|---|
| Dhaka-1 | 155 | 40.00 | 23.80a | 1.77b | 26.00c | 1603c |
| BARI badam-5 | 155 | 40.33 | 10.10c | 1.87b | 44.60b | 1739bc |
| BARI badam-6 | 155 | 37.00 | 15.30b | 2.03b | 54.83a | 1958ab |
| Jhinga badam | 160 | 40.66 | 11.10bc | 3.07a | 40.50b | 2106a |
| CV (%) | -- | 12.18 | 15.96 | 12.19 | 10.09 | 7.32 |

Means followed by common letters are statistically similar at 5% level.

# SCREENING OF DIFFERENT RABI CROPS IN SALINE AREA


## Abstract

Different rabi crops specially vegetables and pulses were screened in saline area of Khulna under AEZ-13 during 2002-2003. Salinity level in the area ranges between 1.81 –6.14 mm hos/cm during the crop growing season. Tomato, Chilli, radish, chickpea and lentil were grown as test crop. Among those crops tomato and Chilli were found feasible and profitable.


## Introduction

Out of 2.83 million hectares in the districts of Bangladesh, about 0.84 million hectares are affected by varying degrees of salinity from the SRDI soil test report. Salinity level is low from May to November but salinity level is the highest during rabi season. As a result, it is very difficult to grow rabi crops in that area. From previous results of studies in saline area, It was observed that some crops can be grown. So, it is needed to screen the crops that can withstand certain levels of salinity.

## Materials and Methods

The experiment was conducted in farmers' field at Paikgacha MLT site during rabi season, 2002-03. The experiment was laid out in randomized complete block design with four replications. The unit plot size was 2 m x 2 m. Five crops were included in the study viz. Tomato, Chilli, radish, chickpea and lentil. The seed/seedlings were sown as line sowing. Irrigation was given during early growth stage of vegetables. The detail particulars of materials and methods are presented in Table 1. Intercultural operations were done as and when necessary. Data on yield of different crops were collected and cost benefit was done. The soil salinity level during 23 November'02, 07 and 22 December'02, 07 and 22 January'03, 08 and 24 February'03, 08, 18 March'03 and 02 April'03 were 1.81, 2.03, 1.94, 3.31, 4.45, 5.68, 5.13, 5.9, 6.14 and 6.07 mm hos/ cm, respectively.

Table 1. Variety, spacing, fertilizer and harvesting time of different crops

| Crops | Variety | Spacing (cm) | N-P-K (kg/ha) | Harvesting time |
|---|---|---|---|---|
| Tomato | BARI-9 | $60 \times 40$ | 200-80-100 | Feb. 20 to Mar. 10 |
| Chilli | Local | $50 \times 30$ | 70-30-50 | Mar.15 to April 15 |
| Radish | Druti | $30 \times 20$ | 130-50-105 | First week of Feb.'03 |
| Chickpea | BARI-5 | 40 | 20-16-15 | Damaged during Jan.'03 |
| Lentil | BARI-4 | 30 | 20-16-15 | Damaged during Jan.'03 |

## Results and Discussion

The yield performance of different crops and cost benefit are presented in Table-2. Five crops were evaluated in the saline area of Paikgacha of which tomato performed better with higher benefit cost ratio. Although tomato involved higher cost of cultivation but due to its market price higher gross return was achieved. Chickpea and lentil was damaged at January. From the above result it showed that tomato and Chilli could be grown in saline area of Paikgacha area but the experiment needs further investigation for confirmation.

Table 2. Yield and economic performance of different rabi crops at Paikgacha MLT site during rabi, 2002-03

| Crop | Yield (kg/ha) | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|
| Tomato | 23,900 | 1,31,450 | 24,400 | 1,07,550 | 5.39 |
| Chilli | 4,100 | 49,200 | 14,600 | 34,600 | 3.37 |
| Radish | 17,500 | 52,500 | 21,800 | 30,700 | 2.40 |

Price (Tk./kg): Chilli = 12.00, Tomato = 5.50 & Radish = 3.00

**Farmer's reaction**: Farmer's expressed their satisfaction due to higher yield of BARI Tomato-9.

# VERIFICATION OF SELECTED VARIETIES OF WHEAT, MAIZE AND SUNFLOWER AT SALINE AREA


## Abstract

The experiment was conducted at Paikgacha MLT site to screen the different salt tolerant varieties of different crops. The result showed that wheat variety Sourav, Maize variety BARI Maize-5, Sunflower variety Kironi performed better at saline area. Further investigation in relation to management practices need to be done.


## Introduction

In Bangladesh, more than 30% of the cultivable area is in the coast. Coastal areas are seriously affected by various degrees of salinity. After harvesting of T.Aman vast land remain fallow. During rabi season, the soil salinity levels increase through capillary movement. For higher salinity most of the rabi crops do not survive in the area. BARI recently developed many high yielding varieties of cereal and oilseed crops. The performance of the varieties of cereals and oilseeds need to be evaluated in saline area. The present study was therefore, undertaken to find out the suitable varieties of cereals and oilseeds in saline area.

## Materials and Methods

The trial was conducted at Paikgacha MLT site during rabi season 2002-2003. Three different crops were sown on 23 November 2002. Two varieties of wheat (Sourav and Gourab), two varieties of maize (Barnali and BARI Maize-5) and one variety of sunflower (Kironi) were included in the study. The unit plot size was 2 m × 1 m. Seeds were sown following RCB design with four replications. The seeds were sown as line sowing. One irrigation was given. The detail particulars of materials and methods are presented in Table 1. Intercultural operations were followed as and when necessary. The soil salinity level during 23 November'02, 07 and 22 December'02, 07 and 22 January'03, 08 and 24 February'03, 08 and 18 March'03 and 02 April'03 were 1.81, 2.03, 1.94, 3.31, 4.45, 5.68, 5.13, 5.90, 6.14 and 6.07 mm hos/cm, respectively. Data on yield and yield attributes were collected and analyzed statistically

Table 1. Methods of sowing, spacing and fertilizer dose for different crops

| Name of crops | Method of sowing | Spacing (cm) | Fertilizer dose (kg/ha) | | | | |
|---|---|---|---|---|---|---|---|
| | | | N | P | K | S | Zn |
| Wheat | Line | 20 | 82 | 28 | 25 | 20 | - |
| Maize | Line | 75 × 25 | 92 | 30 | 50 | 27 | 4 |
| Sunflower | Line | 50 × 25 | 92 | 40 | 75 | 30 | 3.5 |

## Results and Discussion

Performance of different crop varieties has been presented in table-2. Plant height and grain yield differed significantly by varieties of wheat. Sourav produced significantly the highest grain yield could be due to higher spike/m$^2$, longer spike and more number of grain/spike.

Grains/cob, 1000-grain weight and grain yield differed significantly by varieties of maize. The variety BARI Maize-5 produced significantly higher yield due to more number of grains/cob and grain weight.

Sunflower variety, Kironi was introduced which yielded 1020 kg/ha.

Table-2. Yield and yield attributes of different crops tested at Paikgacha MLTS during rabi season, 2002-03

**a) Wheat**

| Variety | Days to maturity | Plant height (cm) | Spike/$m^2$ | Spike length (cm) | Grain/ Spike | 1000 grain wt. (g) | Grain yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Sourav | 108 | 92.75 | 209 | 10.70 | 37.50 | 35.35 | 2.34 |
| Gourab | 106 | 95.50 | 205 | 10.30 | 35.00 | 36.20 | 2.13 |
| LSD (0.05) | - | 2.38 | NS | NS | NS | NS | 0.19 |
| CV ( %) | - | 1.13 | 1.83 | 2.86 | 8.20 | 1.89 | 3.78 |

**b) Maize**

| Variety | Days to Maturity | Plant pop./$m^2$ | Plant height (cm) | Cob/ plant | Grain /cob | 100-grain weight (g) | Grain yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Barnali | 120 | 4.50 | 182 | 1.27 | 319 | 14.72 | 2.96 |
| BARI Maize-5 | 123 | 4.50 | 185 | 1.37 | 342 | 16.77 | 3.21 |
| LSD (0.05) | - | NS | NS | NS | 20.92 | 1.86 | 0.16 |
| CV (%) | - | - | 2.31 | - | 2.81 | 5.27 | 2.23 |

**c) Sun flower**

| Variety | Days to maturity | Plant height (cm) | Head diameter (cm) | Seed/head (No.) | 1000 seed weight (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|
| Kironi | 90 | 121 | 13 | 261 | 56 | 1020 |

## Conclusion

It was observed that wheat variety Sourav, maize variety BARI Maize-5 and sunflower variety Kironi showed better adaptability in saline area. These crops can be grown in Fallow-Fallow-Fallow or Fallow-T.Aman-Fallow cropping pattern. The experiment needs to be repeated another year and besides management practice could be done.

### Farmers' reaction

Farmers preferred wheat, maize and sunflower for their adaptability in saline area. Farmers preferred dwarf sunflower variety.

# OBSERVATION TRIAL OF SESAME AND SUNFLOWER MIXED CROPPING


## Abstract

An experiment was conducted at Banerpota Farm, Satkhira during Kharif season to determine the optimum seeding rates of sunflower and sesame as mixed cropping. Five different seeding combinations of sesame and sunflower crops were studied. The highest sesame equivalent yield (1.44 kg/ha) but the highest gross return, gross margin and benefit cost ratio (1.44) were obtained from sole sunflower. Mixed cropping of sesame and sunflower was not found feasible in saline area.


## Introduction

Mixed cropping as a method of crop intensification is commonly practiced in densely populated countries to provide more food and some times to cover risk from natural calamities. Farmers are habituated to cultivate sesame as a sole crop. But almost every year excess rainfall damage the crop due to water logged condition. As a result sesame cultivation becomes losing concern to the farmer for that year. To cover the risk of damaged, sunflower with sesame mixed cropping can earn something from sunflower. The present study was therefore, under taken to determine the optimum seeding rates of sunflower that could be grown with sesame without affecting its yield.

## Materials and Methods

The experiment was conducted during the period from February to May, 2003 at Banerpota Farm, Satkhira. The treatments were monoculture sesame, sunflower and three seeding combinations (100% sesame + 10% sunflower, 100% sesame + 20% sunflower and 100% sesame + 30% sunflower) were included in the study. The experiment was laid out in a randomized complete block design with three replications. The size of unit plot was 5 m × 4 m. The seeding rates of sesame and sunflower 8 and 12 kg/ha for the sole crop. The local cultivar for sesame and Kironi for sunflower were used. The seeds were sown on 10 February, 2003. Fertilizers were applied at the rate of 50 kg N, 28 kg P, 23kg K, 20 kg S, 1.8 kg Zn and 1.8 kg B/ha through Urea, TSP, MP, Gypsum, $ZnSO_4$ and Boric acid, respectively. All TSP, MP, Gypsum, $ZnSO_4$, Boric acid and half of urea was applied at final land preparation. The rest of half urea was applied at 25 DAS. One irrigation was given. All intercultural operations were done as and when necessary. Harvesting of sesame was done on 15 May 2003 and sunflower on 18 May 2003. Data on different yield parameters were recorded and analyzed statistically. Economically analysis was done.

## Results and Discussion

The effect of mixed crop treatments exhibited significant influence on plant population/m$^2$, capsule/plant, seed/capsule, 1000 seed weight and seed yield of sesame (Table 1). The highest seed yield of sesame was obtained from sole sesame crop (1013 kg/ha). Grain yield of sesame and other yield contributing characters gradually decreased with the increase of seeding ratio of sunflower.

Head diameter, 1000 seed weight and seed yield of sunflower differed significantly due to different seeding ratio (Table 2). The highest seed yield was obtained from sole sunflower. The lowest seed yield of sunflower was obtained from mixed cropped with seeding ratio of 10%. The highest yield of sole sunflower could be due to its maximum seed/head and seed weight. Due to higher population per unit area, the intra and inter crop competition increased which resulted in lower yield/plant.

### Cost benefit analysis

The sole sunflower produced the highest sesame equivalent yield. The highest gross return, gross margin and benefit cost ratio were obtained from sole sunflower. The result showed that mixed cropping of sesame and sunflower was not found feasible. For more confirmation the trial should be continued in next year.

Table 1. Effect of mixed cropping on the yield and yield attributes of sesame at Banerpota Farm, Satkhira during Kharif season, 2003

| Treatments | Plant pop./$m^2$ | Plant height (cm) | Capsule/ plant | Seed/ capsule | 1000 seed weight (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|
| 100% Sesame | 30.00a | 86.33a | 50a | 52a | 2.20a | 1013a |
| 100% Sunflower | - | - | - | - | - | - |
| 100% Sesame + 10% Sunflower | 27.00ab | 83.67ab | 39b | 39b | 2.09b | 594b |
| 100% Sesame + 20% Sunflower | 25.33ab | 80.67b | 37b | 35b | 2.05bc | 440c |
| 100% Sesame + 30% Sunflower | 22.00b | 80.00b | 30c | 31b | 2.01c | 337d |
| LS | * | * | * | * | * | * |
| CV (%) | 10.08 | 2.91 | 6.21 | 11.85 | 1.51 | 5.75 |

Means followed by common letters are statistically similar at 5% level.

Table 2. Effect of mixed cropping on the yield and yield attributes of sunflower at Banerpota Farm, Satkhira during Kharif season, 2003

| Treatments | Plant height (cm) | Head diameter (cm) | Seed/head | 1000 seed weight (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|
| 100% Sesame | - | - | - | - | - |
| 100% Sunflower | 127 | 14.67a | 414 | 70.25a | 1416a |
| 100% Sesame + 10% Sunflower | 117 | 13.45b | 400 | 68.96b | 162d |
| 100% Sesame + 20% Sunflower | 120 | 13.10c | 391 | 67.67c | 299c |
| 100% Sesame + 30% Sunflower | 124 | 12.93c | 390 | 67.35c | 425b |
| CV (%) | 5.26 | 1.18 | 3.46 | 1.00 | 5.04 |

Means followed by common letters are statistically similar at 5% level.

Table 3. Cost and return analysis of sesame and sunflower

| Treatments | Sesame equivalent (kg/ha) | Gross return (Tk/ha) | TVC (Tk/ha) | Gross margin (Tk/ha) | Benefit-cost ratio |
|---|---|---|---|---|---|
| 100% Sesame | 1013 | 12156 | 9150 | 3006 | 1.33 |
| 100% Sunflower | 1416 | 16992 | 11790 | 5202 | 1.44 |
| 100% Sesame + 10% Sunflower | 756 | 9072 | 8950 | 122 | 1.01 |
| 100% Sesame + 20% Sunflower | 739 | 8868 | 8900 | -32 | 0.99 |
| 100% Sesame + 30% Sunflower | 762 | 9144 | 9010 | 132 | 1.01 |

**Price** (Tk./kg): Sesame : 12.00 Sunflower: 12.00

# INTERCROPPING GROUNDNUT WITH CHILLI


## Abstract

The field experiment was conducted of Farming systems Research & Development site Lebukhali, Patuakhali during rabi 2002-03 to find out agronomic performance of inter cropping groundnut with Chilli. The highest yield of (3.06) was recorded from sole Chilli.


## Introduction

Intercropping is the growing of two or more crops or cultivars simultaneously in the same piece of land in alternate rows or set of rows. Most of the farmers practice inter cropping, in which one of the crops is usually regarded as the main crop and the other as the inter crop. Recently intercropping has been recognized by the farmers as a potentially beneficial system of crop production. Intercropping often gives higher cash return and total production per hectare than growing one crop alone. Intercropping is commonly practiced in densely populated countries like Bangladesh to provide more food. In Patuakhali district, Chilli is a major rabi crop generally grown as sole crop. Groundnut is grown sporadic and in some pocket areas. So, to increase the production of groundnut, intercropping may be good practice. There fore, the experiment was undertaken to increase groundnut production of the locality and to find out agronomic performance of inter cropping groundnut with Chilli.

## Materials and Methods

The experiment was conducted under rainfed condition at FSRD site Lebukhali, Patuakhali during rabi season of 2000-03. The experiment was laid out in RCB design with 5 replications. The unit plot size was 6 m x 5 m. The five treatments were, $T_1$ = Sole Chilli, $T_2$ = One row of Chilli alternate with one row groundnut, $T_3$ = One row Chilli of alternate with two row groundnut $T_4$ = One row Chilli alternate with three rows groundnut $T_5$= Sole Groundnut. Seed of groundnut (var. ACC-12) and Chilli (var. Local) were sown on 23 December with spacing 40 cm x 25 cm for Chilli and 40 cm x 15 cm for groundnut. A fertilizer dose of 210kg/ha urea 300kg/ha of TSP and 200kg/ha of MP were used. All fertilizer was applied as basal at the time of final land preparation. During cropping period only 30 mm rainfall was obtained in 2002-2003. Harvest completed 20 May, 2003.

## Result and Discussion

The highest yield of Chilli 1570 kg/ha were obtained from Chilli sole crop followed by 1C: 1G combination. The highest yield of groundnut 2430 kg/ha were obtained from sole groundnut followed by 1C: 3G combination. The highest Chilli equivalent yield was recorded from soil Chilli. All the intercropped system failed to show higher Chilli equivalent yield and gross return. But the highest gross margin was obtained from sole groundnut but due to higher cost it failed to earned higher benefit than sole Chilli.

## Conclusion

This is first year experiment .It repeat next year and treatment combination will be rearranged.

Table-1. Yield, equivalent yield and LER of Chilli and groundnut intercropping

| Treatment | Plant/plot | | Yield (kg/ha) | | Chilli equivalent yield (kg/ha) | LER |
|---|---|---|---|---|---|---|
| | Chilli | Groundnut | Chilli | Groundnut | | |
| Sole Chilli | 240 | - | 1570 | - | 1570 | 1.00 |
| 1C :1G | 120 | 200 | 805 | 1285 | 1447 | 1.04 |
| 1C : 2G | 90 | 225 | 700 | 1375 | 1387 | 1.01 |
| 1C: 3G | 60 | 300 | 456 | 1798 | 1355 | 1.03 |
| Sole groundnut | - | 400 | - | 2430 | 1215 | 1.00 |

Table 2. Cost and return of Chilli and Groundnut intercropping at Patuakhali during rabi 2002-03

| Treatment | Gross return (Tk./ha) | Production cost (Tk./ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|
| Sole Chilli | 62800 | 20500 | 42300 | 3.06 |
| 1C : 1G | 57880 | 21500 | 36380 | 2.69 |
| 1C : 2G | 55480 | 21500 | 33980 | 2.58 |
| 1C :3G | 54200 | 21500 | 32700 | 2.52 |
| Sole groundnut | 48600 | 20000 | 46000 | 2.43 |

C= Chilli , G= Groundnut

**(Rainfed Farming)**

# PERFORMANCE OF DIFFERENT CHICKPEA CULTIVARS UNDER OPTIMUM MANAGEMENT CONDITIONS IN THE HIGH BARIND TRACT, BANGLADESH


## Abstract

Performance of five chickpea cultivars viz. Annigeri, BARI Chola-2, BARI Chola-3, BARI Chola-5 and local were evaluated under rainfed conditions in the High Barind Tract. For all the cultivars dry matter accumulation (DM) and crop growth rate (CGR) were maximum at pod-filling stage. Annigeri gave markedly higher DM from pod-filling stage to maturity over other cultivars. Further Annigeri had distinctly superior CGR at pod-filling stage but it dropped quickly at maturity. Because in general the cultivars were 3-5 days earlier in comparison to other varieties. Thus Annigeri is suitable for avoiding terminal stage drought. Over the years, Annigeri gave the highest seed yield, 100-seed weight and apparently higher harvest index (HI). However, 23 more days were required for completion of life cycle of all cultivars in 2002-03 as compared to 2001-02 due to exceptionally low temperature and foggy weather in January, 2003. To complete the life cycle of the plants 24°1-.27°C days were required in 2001-02, whereas 2982.82°C days were needed in 2002-03. All the cultivars produced lower grain yield in 2002-03 in comparison to previous year due to reduced portioning of photoassimilates to seed, because excessive rainfall enhanced robust vegetative growth at the cost of seed yield.


## Introduction

Bangladesh Agricultural Research Institute (BARI) has released several cultivars. From a recent Ph. D. experiment (Ali, 2000) it was proved that two other cultivars Annigeri and ICC 4958 seems to be better yielded in the High Barind Tract (HBT). Moreover, Ali (2000) identified some traits for the improvement of chickpea for HBT, among them one of the trait was genotype with moderate growth duration which can complete its pod formation before the onset of supra-optimal temperature (>30°C). Annigeri has about one week shorter growth duration in comparison to other released varieties and local cultivars. Another important trait was genotype with deep and prolific rooting capability. Again many workers (Ali, 2000, Krishnamurthy et al., 1996, Saxena et al., 1993)) reported that ICC 4958 and Annigeri had prolific root system across location in drought conditions.

Therefore, those cultivars along with Bangladesh released varieties were evaluated under rainfed optimum management conditions through different agronomic and physiological indicators.

## Materials and Methods

The experiment was conducted under rainfed condition for consecutive two years at Chabbisnagar FSRD site, Rajshahi during Nov-March, 2001-02 and Nov-April, 2002-03. Five chickpea cultivars were tested namely, Annigeri, BARI Chola 2, BARI Chola 3, BARI Chola 5 and Rajshahi local. The experiment was laid out in randomized complete block design with three replications, having 20 $m^2$ units plot size. The experimental land was prepared well by bullock and power-tiller. Fertilizers were applied at the time of final land preparation. Fertilizers (kg $ha^{-1}$) were applied at the rate of $N_{20}$ $P_{20}$ $K_{20}$ $S_{15}$. Seeds were sown on 20 November 2001 and 17 November 2002, maintaining a spacing of 40cm x 10cm. The crops were kept weed and pest free.

For recording dry matter (DM) accumulation over time 5 plants were harvested at random from 35 days after sowing to maturity of the crop. Five plant weights were converted to per $m^2$ for calculating crop growth rate (CGR). CGR was calculated:

Yield and yield attributes data were recorded from randomly selected 10 plants from each plot. Seed and hay yields were taken from a sample area of 6 $m^2$ for each plot. Annigeri was harvested on 21 March 2002 and all other varieties were harvested on 26 March 2002. In 2003 all the five cultivars were harvested on 10 April. The collected data were analyzed statistically.

## Results and Discussion

**Dry matter (DM):** All the three BARI released chickpea varieties had good DM accumulation at vegetative stage, however, from pod-filling stage Annigeri had distinct superiority in DM production over four other cultivars, particularly at pod-formation stage (Figure 1a and 1b). BARI Chola 3 had also good DM accumulation at pod-filling stage but it sharply decreased from 110 and 120 days in BARI 2001 & 2002 respectively, resulted in inferior DM. In 2002 at the later stage of growth (110-120 DAS) Rajshahi local gave apparently superior DM production over the BARI released varieties, however in 2003 at later stage of growth (110-130 days) it produced the lowest DM.

Rapid DM production at flowering to pod-filling stages indicated that chickpea plants need sufficient water and nutrients to achieve the yield potential associated with other environmental factors such as clear sunshine and particularly air temperature below 30$^o$ C (Ali, 2000).

**Crop growth rate (CGR):** Due to distinct difference (rainfall, temperature and sunshine hours) between weather conditions of 2001-02 and 2002-03 chickpea growing period, the CGR curve varied widely. For 2001-02 a typical CGR curve was obtained, which was not observed in 2002-03. At vegetative stage BARI Chola 3 had the highest CGR (Figure 2a and 2b), but it rapidly dropped at pod-filling stage. Annigeri had slow CGR at vegetative stage but it increased geometrically at pod-filling stage and attained its peak at 80-90 days and then it became negative at 95-110 days, as it was comparatively a short duration genotype (Ali, 2000, Rao and Rao, 2000). By contrast all other four varieties had positive CGR up to 95-110 days and they had negative CGR only at maturity (110-120 days). Thus Annigeri had the advantages to avoid terminal drought, which often occurred at pod-filling to ripening stages of the crops in the HBT region (AEZ 26).

**Growing degree day (GDD)/Thermal time:** GDD or thermal time starts with the assumption that the growth of plants is dependent on total amount of heat it required to initiate or complete a physiological process or to complete its life cycle.

In 2001-2002 when in general normal weather conditions (Figure 3) prevailed chickpea plants required 24$^0$-27$^O$C day for completing its life cycle. While in 2002-03 when the month of January was abnormally cool (Fig 3) and foggy (i.e. less sunshine hour) it required 2982.82$^O$C days for completion of its life cycle. Thus 581.55$^O$ C days more were needed in 2002-03 compared to 2001-02 to recover from cooling effect (vernalization). As it is reported that optimum temperature regime of chickpea is 25$^o$/10$^o$ C day/night (Khanna-Chopra and Sinha, 1987). Thus duration of crop is modified by prevailing temperature regimes. From the results of controlled environment it was observed that duration of chickpea reproductive growth was short (67 to 71 days) in 30/18$^O$ C day/night temperatures compared to 96 to 112 days at 22/10$^O$C day/night (Roberts et al., 1980). Further if we consider same duration (121 days) of crops for both years, it revealed that only 86.77$^O$C day was less for 2002-03 year crop compared to 2001-02 year crop resulting in 23 more days or 581.55$^O$C day for completion of life cycle. The findings suggest that probably 2401.27$^O$C day could be within optimum thermal time regime for completing the life cycle of chickpea crop for normal year.

**Yield and yield attributes:**

Annigeri gave the highest seed yields in both years due to combined effects of good number of pods/plant, seed/pod and the heaviest 100-seed weight (Table 1). However in 2002-2003, BARI Chola-5 and BARI Chola-3 were at par with seed yield of Annigeri. In proper management situation the potential of local cultivar was distinct in 2001-02. But in 2003 local variety gave the lowest seed yield, but it was identical to BARI Chola-2 and BARI Chola-3. Other workers also reported that Annigeri produced higher yield over BARI Chola 2 and 5, particularly in drought year in the HBT. The two years consistent result indicated that Annigeri could be considered as an effective alternative for BARI Chola-5, BARI Chola-2 and BARI Chola-3, which would be needed for widening the genetic base for avoiding sudden decrease of yield level due to disease, pest and drought. Significantly heaviest seed weight was obtained from Annigeri, while had the lowest weight.

In both the years Annigeri possessed apparently the highest harvest index (HI) over other cultivars. One of the reasons of higher seed yield by Annigeri was due to its rapid dry matter partitioning to seed at pod-filling stage.

Difference between the yield and duration of two years crops were due to excessive rainfall at pod-filling stage and abnormally low temperature in January 2003. In 2002-03 harvest index low in comparison to previous year due to excessive vegetative growth because of high rainfall. Thus for a legume crop like chickpea partitioning of dry matter to seed is the key deciding factor for obtaining potential yield. Because an excess of soil moisture caused by frequent rain or too much irrigation, leads to excessive vegetative growth, at the expense of seed.

## Conclusions

Genotype Annigeri produced higher seed yield over the years due to genetic factor (bigger seed size and more number of pods per plant) as well as physiological factors, such as, rapid dry matter partitioning to grain at pod-filling stage and by escaping terminal high temperature through its shorter growth duration. Hence, Annigeri could be regarded as an alternative cultivars than the existing cultivars.

## References

Ali, M. Y. 2000. Influence of phosphorus fertilizer and soil moisture regimes on root system development, growth dynamics and yield of chickpea. Ph. D. Thesis, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur, Bangladesh.

Krishnamurthy, L., C. Johansen and O. Ito. 1996. Genotypic variation in root development and its implications for drought resistance in chickpea, pp. 235-250. *In* Dydamics of Roots and Nitrogen in Cropping Systems of the Semi-Arid Tropics (O. Ito, C. Johansen, J. J. Adu-Gyamfi, K. Katayana, J. V. D. K. Kumar Rao and T. J. Rego, eds.). Japan International Center for Agricultural Sciences.

Khanna-Chopra, R. and S. K. Sinha. 1987. Chickpea: physiological aspects of growth and yield, pp. 163-189. *In* The Chickpea (eds. M. C. Saxena and K. B. Singh). Pub. By CAB International.

Rao, G, V, R. and V. R. Rao. 2000. Packages of practices for chickpea cultivation. International Crops Research Institute for the Semi-Arid Tropics, Patancheru, A. P. India.

Roberts, E. H., R. J. Summerfield., F. R. Minchin and P. Hadley. 1980. Phonology of chickpeas (Cicer arietimum L) in contrasting aerial environments. Expl. Agric. 16:343-360.

Saxena, N. P., L. Krishnamurthy, and C. Johansen. 1993. Registration of a drought- resistant chickpea germplasm. Crop Science 33: 1424.

Table 1. Yield and yield attributes of different chickpea genotypes at High Barind tract, Rajshahi, 2002-03

| Genotypes | Plant height (cm) | Pods/plant | 100-seed wt. (g) | Grain Yield (t/ha) | | HI* |
|---|---|---|---|---|---|---|
| | | | | 01-02 | 02-03 | |
| Annigeri | 46.05a | 53 | 18.65a | 1.84a | 2.01a | 48.05a |
| BARIChola-2 | 38.90a | 39 | 11.70c | 1.33bc | 1.80b | 41.65a |
| BARIChola-3 | 46.37a | 41 | 15.42b | 1.44abc | 1.75b | 42.10 |
| BARIChola-5 | 46.05a | 42 | 12.22c | 1.59ab | 1.85b | 45.41 |
| Local | 39.10a | 47 | 10.80e | 1.07c | 1.81b | 39.53a |
| CV (%) | 11.8 | 9.2 | 7.2 | 17.3 | 8.1 | 13.6 |

Means followed by a common letter are not significantly different at the 5 % level by DMRT.
* HI = Harvest Index

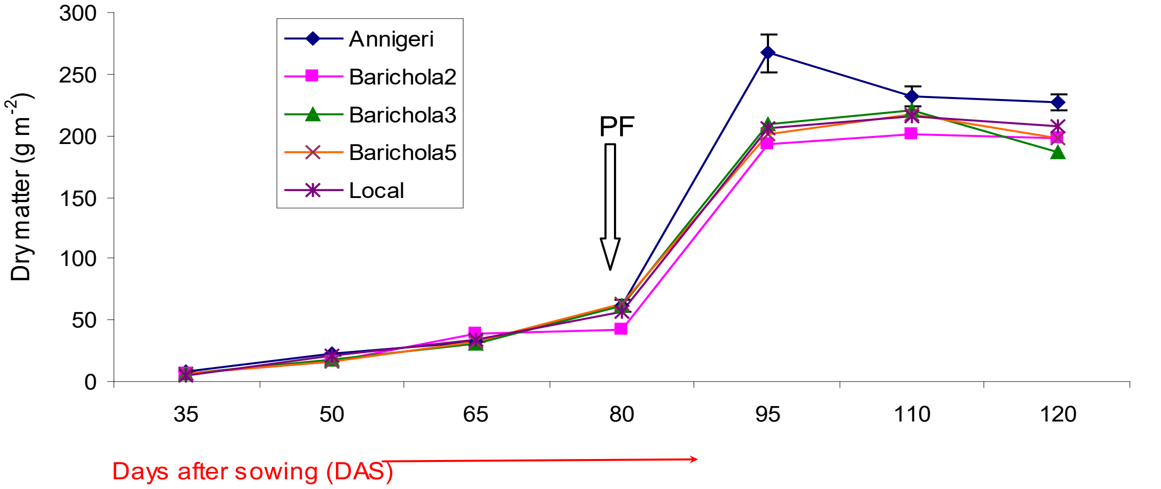


Fig 1a. Aerial dry matter accumulation of different chickpea genotypes over time, High Barind Tract, Bangladesh, 2001-2002 (vartical bar is SE of genotype means, PF = pod filling stage).

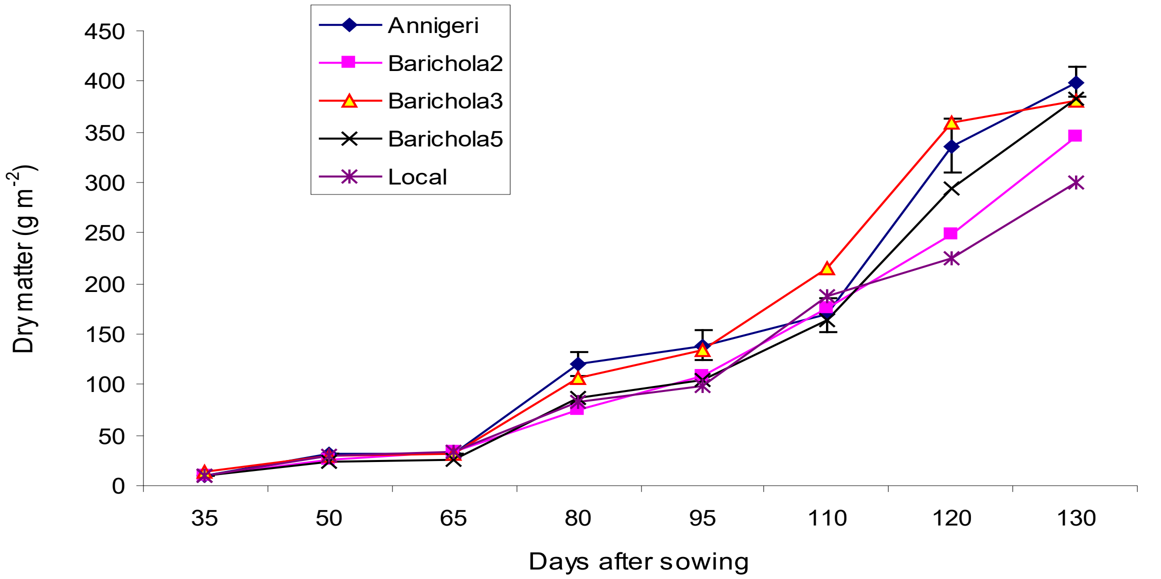


Fig 1b. Dry matter accumulation of different chickpea genotypes over time, High, Barind Tract, Rajshahi, 2002-03 (Vertical bar indicates SE).

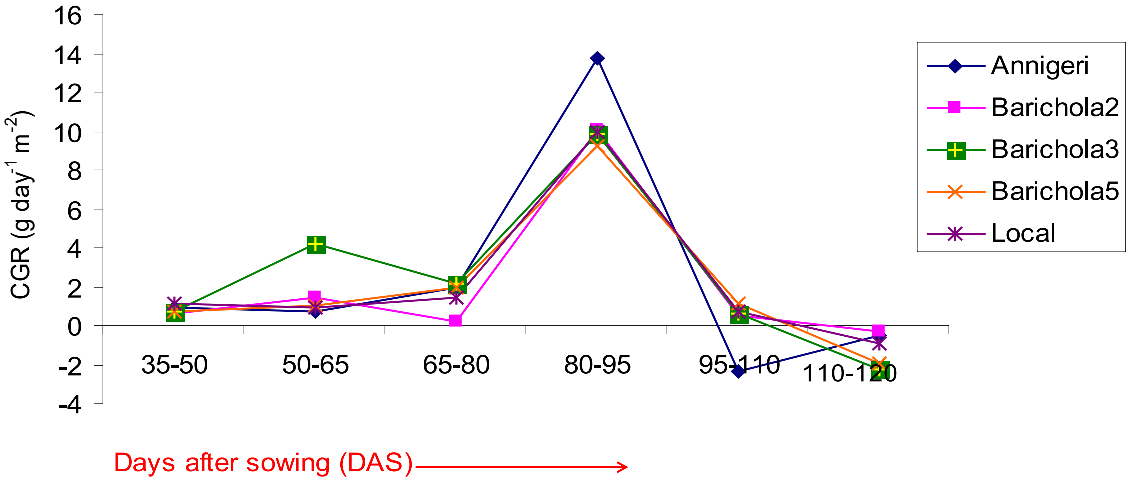


Fig 2a. Crop growth rate (CGR) of different chickpea genotypes under rainfed conditions, High Barind Tract, Bangladesh, 2001-02.

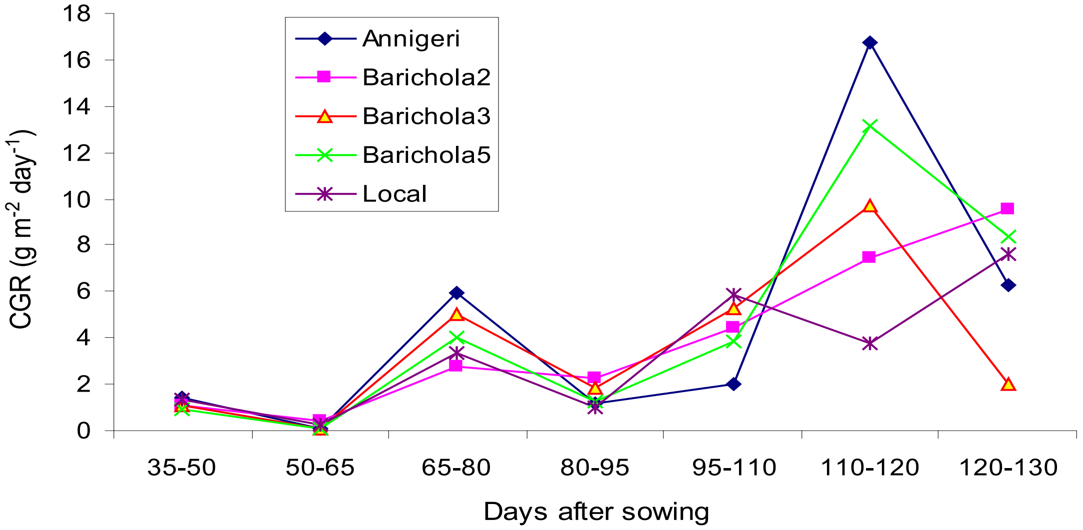


Fig 2b . Crop growth rate (CGR) of different chickpea genotypes over time, High Barind tract, Rajshahi, 2002-03.

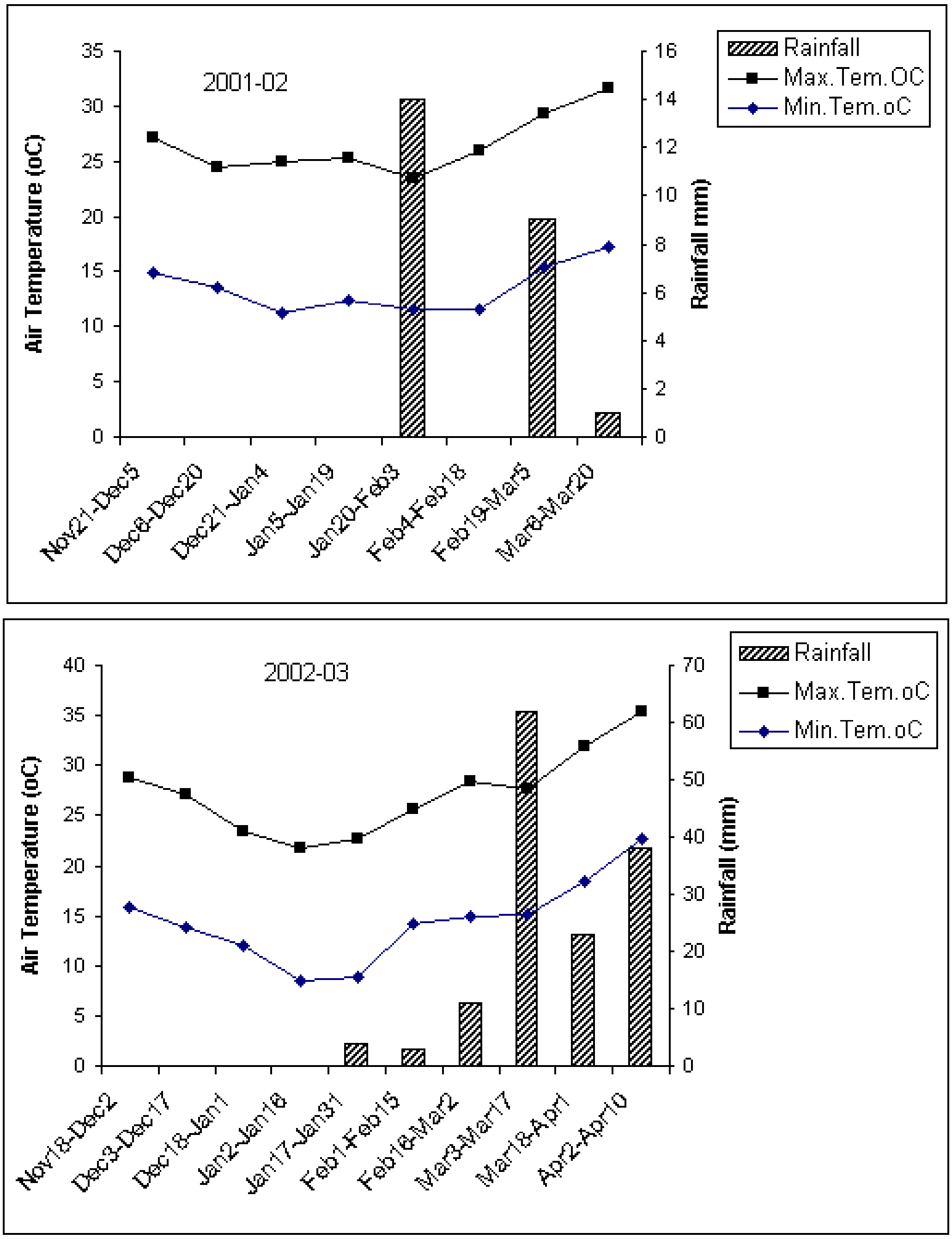


Figure 3. Fortnightly mean air temperature and total rainfall during chickpea growing period, High Barind Tract, Rajshahi, 2001-03

# RESPONSE OF T.AMAN-CHICKPEA CROPPING PATTERN TO APPLIED PHOSPHORUS IN THE HIGH BARIND TRACT, BANGLADESH


## Abstract

Residual effect of P in chickpea was evaluated in previous wet land rice crop (T.Aman rice) along with P and/or P + irrigation. In 2001-02, no positive response of residual P was observed for chickpea yields and yields attributes; rather, in general P application (20 kg P $ha^{-1}$) under both irrigated or non-irrigated conditions gave higher grain yield. However, in 2002-03 (which was environmentally different from normal year) residual effect of P was observed for chickpea crop applied in previous T.Aman rice. In T.aman rice when 20 to 60 kg P $ha^{-1}$ was applied, it gave comparatively higher chickpea yields over no P fertilizer either under irrigated or rainfed conditions. For both year P application response in T.Aman rice was also not significant.


## Introduction

The availability of soil P or added P is very important for root and shoot growth, as well as for partitioning of dry matter to seed (Ali, 2000, Tandon, 1987). Again availability of soil P added P depends on optimum soil moisture (Saraf et al., 1990, Singh and Sharma, 1980, Kulthare et al., 1988). However, residual effect of P is clearly proved in Bangladesh and elsewhere (Abedin and Mukhopadhyay, 1990; Tandon, 1987). In the HBT, T.Aman - Chickpea is a major cropping pattern. If proper amount of P is applied to T.Aman rice, probably it can compensate the demand of P for chickpea in the HBT context. Moisture holding capacity of HBT soil is poor due to critical organic matter contents and low infiltration rate of water (Ali, 2000). In such a situation if soil is opened by plowing or furrowing and exposed to sun drying for long time, soil moisture goes out quickly resulting in poor germination of seeds. Moreover, fertilizer response was not studied in the HBT for the T.Aman-Chickpea cropping pattern. So the present experiment was taken with the following objectives:

- To find out the residual effect of P fertilizer on chickpea used in previous T, aman rice
- To find out the interaction between P x soil moisture on chickpea

## Materials and Methods

The experiment was conducted for consecutive two years (July to March, 2001-02 and 2002-03) at FSRD site Chabbisnagar, High Barind Tract (HBT), Rajshahi, T.aman rice variety BRRI Dhan 39 was transplanted (35 days old seedlings) on 28 July, 2001 and 20 July, 2002, maintaining a spacing of 25cm x 15 cm. The experiment was set up in a RCB design with three dispersed replications. The unit plot size was 6 m x 10 m. Four Phosphorus (P) fertilizer doses 0, 20, 40 and 60 kg P $ha^{-1}$ were tested,. Source of P was triple super phosphate and applied as basal. The common fertilizer doses for all the treatment were $N_{70}$ $K_{40}$ $S_{20}$ $Zn_1$ kg $ha^{-1}$ applied in the form of urea, muriate of potash, gypsum and zinc oxide, respectively, applied at the time of final land preparation. T.Aman rice was harvested at maturity on 29 October 2001 and 21-30 October 2002, respectively.

Each rice plot was divided into four equal parts (15 $m^2$) and the four treatments were imposed such as one irrigation at 40 DAS with zero P, one irrigation at 40 DAS with $P_{20}$, rainfed with zero P & rainfed with $P_{20}$. Sixteen treatment combination (four P levels of T.Aman rice & four for chickpea) were tested (Table 4).

Chickpea crop (BARI Chola 2) was sown on 19 November, 2001 and 31 Oct to 3 Nov, 2003, maintaining a spacing of 40 cm x 10 cm following RCB design with three dispersed replications. Only one light irrigation was applied at 40 days after sowing for irrigated treatments. Phosphorus fertilizer was applied as TSP in each furrow just before the sowing of seeds to maximize uptake (Arihara and Okada, 1991).All other common fertilizer ($N_{20}$ $K_{20}$ $S_{15}$ $B_1$ kg $ha^{-1}$) was applied as basal in the form of urea, muriate of potash, gypsum and boric acid. Chickpea was harvested at maturity on 15 March 2002 and 8 March 2003.

For T.Aman rice and chickpea, yield attributed data were recorded at physiological maturity from 10 randomly selected plants from each plot. Soil samples were chemically analyzed before planting of T.Aman rice and after harvest of T.Aman. Soil samples were collected after chickpea and sent for chemical analyses but data yet not received.

Table 1. Nutrient status of initial soil sample* (0-15 cm depth) before the transplanting of T.aman rice, HBT, 2001

| pH | Organic matter (%) | meq/100g soil | | | % Total N | Micro g/g soil | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ca | Mg | K | | P | S | B | Zn |
| 5.7 | 0.82 | 4.72 | 2.05 | 0.26 | 0.07 | 6.17 | 15 | 0.18 | 1.22 |

*Composite sample, mean of three replications.

Table 2. Nutrient status of soil sample* after harvest of T.Aman rice (0-15 cm depth), HBT, 2001

| Treatment | pH | Organic matter (%) | meq/100g soil | | | % Total N | Micro g/g soil | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ca | Mg | K | | P | S | B | Zn |
| $P_0$ | 6.55 | 0.75 | 5.1 | 1.9 | 0.18 | 0.04 | 2.9 | 6.00 | 0.28 | 0.83 |
| $P_{20}$ | 6.55 | 0.81 | 5.4 | 2.0 | 0.22 | 0.04 | 3.9 | 8.80 | 0.27 | 1.00 |
| $P_{40}$ | 6.20 | 0.786 | 4.6 | 1.9 | 0.30 | 0.04 | 5.9 | 9.80 | 0.46 | 0.95 |
| $P_{60}$ | 6.05 | 0.82 | 4.9 | 2.0 | 0.28 | 0.05 | 7.35 | 8.00 | 0.38 | 0.90 |

*Mean of three replications

## Results and Discussion

### Effect of T.aman rice

T.Aman rice yield and any one of the yield attributes were not significantly influenced by application of phosphate (P) for both years (Table 3), though status of available soil P was low (Table 1). This could be due to the fact that under flooded conditions non-labile P became labile. Because in most soils there is an increase in available P after flooding, largely due to a conversion of $Fe^{3+}$ phosphate to soluble $Fe^{2+}$ phosphate and hydrolysis of Al phosphate. Other mechanisms resulting in increased P availability following submergence include dissolution of occluded P, hydrolysis of Fe phosphate, increased solubility of Ca phosphate in calcareous soils, and greater diffusion of P. However, soil P status (after rice harvest) was slightly increased because of application of P in T.Aman (Table 2).

**Chickpea:** Phosphorus that was applied in previous T.Aman rice had no effect on succeeding chickpea crop (Table 4). Rather higher grain yields were obtained from the treatments where P fertilizer and/or P + irrigation were applied except the treatments $RP_{40}I_1P_0$ and $RP_{20}I_1P_0$. As chickpea canopy growth was comparatively poor, effect of P on yield was also not always large. Ali (2000) clearly proved that P response to chickpea crop depends on good canopy growth and the uptake of P in HBT could vary from 3 kg to 15 kg $ha^{-1}$. Moreover, due to moisture stress conditions at later stage of the crop growth P diffusion (the major way of P anion movement from soils to root surface) was supposed to be very low. As under moisture stress the water films around the soil particles are thin and path length increases, reducing P diffusion to the roots. Despite that N and P are important for high yields when water is limiting (Tisdale et al., 1997), particularly for legumes P requirement is more (Tandon, 1987).

The above results indicate that residual effect of P in T.Aman-chickpea cropping pattern was not visible probably because of shifting of land from wet conditions to complete dry conditions. Therefore, it appears that P should be applied in chickpea irrespective of amount of P fertilizer applied in previous T.Aman rice. The results are in agreement with Ali (2000) who suggested 20 kg P $ha^{-1}$ for chickpea production in HBT.

However, the environment of 2002-03 was largely different from pervious year because at active vegetative stage of the crop temperatures of whole January was abnormally cool and foggy. Mean maximum and minimum temperatures of January, 2003 were 22.4$^{O}$C and 8.7$^{O}$C, respectively. And minimum temperatures of 8-24 January were 8.4-6.6$^{O}$C and for two days temperatures were as low as 4.3-4.8$^{O}$C. Those temperatures were much below the optimal temperatures range (Khanna-Chopra and Sinha, 1987) and severely hampered the normal growth of the plants. Moreover about 18 mm rainfall at pod-filling stage and continuous foggy weather made the microenvironment of chickpea canopy moist which promoted vegetative growth at the cost of seed yield. In general, higher seed yield was obtained from the treatment where P was applied in T.Aman rice over the treatment where P was not applied in T.Aman rice despite the application of P in chickpea in 2002-2003. The present results indicated that residual effect of P (applied in T.Aman rice) in succeeding chickpea crop could be visible in good rainy year, probably due to availability of non-labile soil-P because of good soil moisture. However, the fate of P applied in chickpea was not clearly understood.

## Conclusions

In 2001-02, residual effect of P was not observed in chickpea applied in previous T.Aman rice. In general application of 20 kg P ha$^{-1}$ gave higher grain yield in chickpea. But residual effect of P was observed in chickpea applied in previous T.Aman rice, irrespective of P or irrigation applied or not for chickpea in 2002-03. The experiment should be continued for the third year for having a realistic conclusion because the year 2002-03 was environmentally different from normal year.

## References

Arihara, J., N. Ae and K. Okada.1991. Improving responses of chickpea and pigeon pea to phosphorus application in Vertisols and Alfisols, pp. 157-165. *In* Phosphorus Nutrition in Grain Legumes in the Semi- Arid Tropics (C. Johansen, K. L. Lee and K. L. Sahrawat, eds.), ICRISAT, Patancheru, India.

Abedin, M. Z and D. Mukhadhyay. 1990. Cropping system based fertilizer recommendations and soil fertility investigations in farmer's fields. On-Farm Research division, Bangladesh Agricultural research institute and Food and Agricultural Organization of the United Nations, pp.53.

Ali, M. Y. 2000. Influence of phosphorus fertilizer and soil moisture regimes on root system development, growth dynamics and yield of chickpea. Ph. D. Thesis, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur, Bangladesh, pp, 221.

Kulhare, P. S., K. P. Tiwari, R. N. Saran and J. P. Dixit. 1988. Effect of irrigation scheduling and phosphorus doses on chickpea (*Cicer arietinum*) in deep Vertisols. Indian Journal of Agricultural Sciences, 58: 911-914.

Khanna-Chopra, R. and S. K. Sinha. 1987. Chickpea: physiological aspects of growth and yield, pp. 163-189. *In* The Chickpea (eds. M. C. Saxena and K. B. Singh). Pub. By CAB International.

Saraf, C. S., B. Baldev, M. Ali and S. N. Silim. 1990. Improved cropping systems and alternative cropping practices, pp. 105-108. In Chickpea in the Nineties: Proceedings of the Second International Workshop on Chickpea Improvement, 4-8 Dec. ICRISAT, Patancheru, India: ICRISAT.

Singh, S. and H. C. Sharma. 1980. Effect of profile soil moisture and phosphorus levels on the growth and yield of and nutrient uptake by chickpea. Indian Journal of Agricultural Sciences 50: 943-947.

Tandon, H. L. S. 1987. Phosphorus Research and Agricultural Production in India, New Delhi, India: Fertilizer Development and Consultation Organization, pp. 7, 79.

Table 3. Yield and yield attributes of T.Aman rice (cv. BRRI dhan39) as affected by applied phosphorus, HBT, Rajshahi, Bangladesh, 2002

| P levels (kg/ha) | Plant height (cm) | Panicle $m^2$ | Filled grain/ panicle | Grain yield (t/ha) | |
|---|---|---|---|---|---|
| | | | | 2002-03 | 2001-02 |
| 0 | 102.85 | 208 | 81 | 3.22 | 2.92 |
| 20 | 107.00 | 219 | 92 | 3.68 | 3.16 |
| 40 | 103.12 | 222 | 91 | 3.75 | 3.38 |
| 60 | 103.57 | 223 | 92 | 3.76 | 3.63 |
| F.test | NS | NS | NS | NS | NS |
| CV (%) | 4.9 | 9.9 | 11.2 | 11.5 | 7.8 |

Table 4. Effect of residual phosphorus (applied in T.Aman rice), applied P and irrigation on the performance of chickpea (BARI Chola 2), High Barind Tract, Rajshahi, 2002-03

| Treatment | Plant eight (cm) | Pods/ plant | 100-seed wt. (g) | Seed yield (t/ha) | |
|---|---|---|---|---|---|
| | | | | 2002-03 | 2001-02 |
| $RP_{60}I_0P_0$ | 42.03a | 30 | 11.00a | 0.99ab | 0.90cd |
| $RP_{60}I_0P_{20}$ | 38.26a | 32 | 12.10a | 1.03ab | 1.12a-d |
| $RP_{60}$ $I_1P_0$ | 37.73a | 33 | 12.20a | 1.17a | 0.86cd |
| $RP_{60}I_1P_{20}$ | 41.16a | 35 | 12.80a | 1.25a | 1.42a |
| $RP_{40}I_0P_0$ | 39.96a | 31 | 11.00a | 1.09ab | 0.80bcd |
| $RP_{40}I_0P_{20}$ | 37.90a | 34 | 11.40a | 1.20a | 0.93bcd |
| $RP_{40}I_1P_0$ | 42.26a | 35 | 11.80a | 1.23a | 1.09a-d |
| $RP_{40}I_1P_{20}$ | 40.50a | 37 | 12.10a | 1.30a | 1.41a |
| $RP_{20}I_0P_0$ | 38.06a | 29 | 10.71a | 0.95ab | 0.80d |
| $RP_{20}I_0P_{20}$ | 38.63a | 30 | 11.11a | 1.06ab | 1.02bcd |
| $RP_{20}I_1P_0$ | 40.16a | 26 | 11.12a | 0.97ab | 1.21abc |
| $RP_{20}I_1P_{20}$ | 39.20a | 31 | 11.37a | 1.08ab | 1.26ab |
| $RP_0I_0P_0$ | 34.80a | 21 | 10.90a | 0.68b | 0.82d |
| $RP_0I_0P_{20}$ | 33.90a | 23 | 11.13a | 0.69b | 1.07a-d |
| $RP_0I_1P_0$ | 38.06a | 19 | 10.19a | 0.67b | 0.90cd |
| $RP_0I_1P_{20}$ | 34.06a | 19 | 10.57a | 0.67b | 1.12a-d |
| CV (%) | 10.2 | 29.1 | 4.1 | 23.2 | 17.5 |

Same letter in a column do not differ significantly at 5 % level by DMRT.

RP = Phosphorus applied in previous T.Aman rice, $I_0$ = Non-irrigated, $I_1$ = One irrigation at 40 DAS, All P in kg P $ha^{-1}$, designated as P suffix

# MULTILOCATION YIELD TRIAL OF CHICKPEA IN THE HIGH BARIND TRACT


## Abstract

An on-farm trail was conducted at FSRD site, Chabbishnagar and MLT site, Nachole during rabi season, 2002-03 to evaluate the performance of the advance materials over locations. Five entries of chickpea viz. Special plant-7, Special plant-3, BCX –91044-3, BCX –91043-1, BCX –91040-3 and BARI Chola 5 were evaluated in the study. From this study it was observed that tested entries could not able to out yield BARI Chola5 in both location.


## Introduction

In Bangladesh Chickpea (*Cicer arietinum* L.) is the third most important pulse in respect of area and production with an average yield of 765 kg/ha. Its yield is probably most unstable among pulses due to its more sensitivity to micro environment. On the other hand, it has got the highest yield potentiality under favorable environment. Chickpea is found to be a very suitable for dry land rabi crop with residual soil moisture condition. Under Barind stress situation it can be successfully grown after harvesting of short duration T.aman rice. However, more number of varieties are needed for widening the genetic base as well as to avoid dependence on few cultivars. Therefore, the aim of the experiment was to evaluate the performance of advance chickpea germplasms over locations.

## Materials and Methods

The trial was conducted at FSRD site, Chabbishnagar, Rajshahi and MLT site, Nachole during rabi season in 2002-2003. The experiment was laid out in a randomized complete block design with four replications. The unit plot size was 8m x 4m. Five entries of chickpea viz. Special plant-7, Special plant-3, BCX –91044-3, BCX –91043-1, BCX –91040-3 and BARI Chola 5 were included in the study. The seeds were sown in 30 cm row spacing with continuous sowing. The seeds were sown on 28 October 2002 at FSRD site, Chabbishnagar and 29 November 2002 at MLT site, Nachole. The seed rate was maintained 50 Kg/ha. Nitrogen, phosphorus, potassium were applied as basal during final land preparation at the rate of 20 kg N, 40 kg $P_2O_5$ and 20 kg $K_2O$ per hectare in the form of urea, triple super phosphate and muriate of potash, respectively. The crops were harvested on 18 March 2002 at FSRD site, Chabbishnagar and on 31 March 2002 at MLT site, Nachole. Data were collected on different yield components and yield. Analyzed statistically and the differences between treatment means were evaluated by LSD test.

## Results and Discussion

### Chabbisnagar, FSRD site

No significant variation was observed for yield and yield attributes of different chickpea entries and BARI Chola 5 (Table-1). Numerically the tallest plant (57.45 cm), the highest number of pods /plant (56.18) and the heaviest seed weight (14.38 g) were produced by BARI Chola 5 and all these together contributed to the apparently the highest seed yield (1402 kg/ha) in BARI Chola 5.

### Nachole, MLT site

Numerically the tallest plant (45.35 cm), the highest number of pods/plant and the heaviest 100-seed weight (14.13) were observed in BARI Chola 5 which reflected the highest seed yield (718.75 kg/ha) by this variety. The lowest seed yield (570.31 t/ha) was observed in Special plant-7. Overall performance of yield and yield attributes were not satisfactory because attack of pod borer, late sowing and sudden rainfall at pod filling stage. In both the location maturity among different entities and variety were almost same.

## Conclusion

In both the locations the tested new entries could not able to out yield check variety BARI Chola5. Hence, more number of potential entries is to be searched out from home and abroad for achieving high yield potential.

Table 1.Performance of different entries of chickpea and BARI Chola-5 at FSRD site, Chabbishnagar, Rajshahi and Nachol, Chapainababgonj during 2002-03

| Treatment | Plant height (cm) | Pods plant$^{-1}$ (No.) | 100-seed weight (g) | Seed yield (kg ha$^{-1}$) | Duration (days to harvest) |
|---|---|---|---|---|---|
| **Chabbishnagar** | | | | | |
| $T_1$=Special plant-7 | 53.75 | 54.80 | 13.53 | 1252 | 131 |
| $T_2$=Special plant-3 | 52.40 | 47.35 | 13.00 | 1187 | 131 |
| $T_3$=BCX-91044-3 | 56.00 | 42.60 | 14.00 | 1150 | 131 |
| $T_4$=BCX-91043-1 | 56.80 | 42.20 | 14.05 | 1142 | 131 |
| $T_3$=BCX-91040-3 | 55.30 | 55.95 | 14.05 | 1257 | 131 |
| $T_6$=BARI Chola 5 | 57.45 | 56.18 | 14.38 | 1402 | 130 |
| LSD (0.05) | NS | NS | NS | NS | NS |
| CV (%) | 5.00 | 11.30 | 5.58 | 11.65 | 0.72 |
| **Nachole** | | | | | |
| $T_1$=Special plant-7 | 41.75 | 33.70 | 14.00 | 570c | 130 |
| $T_2$=Special plant-3 | 44.45 | 38.05 | 14.08 | 680ab | 129 |
| $T_3$=BCX-91044-3 | 42.25 | 33.25 | 13.63 | 625bc | 129 |
| $T_4$=BCX-91043-1 | 44.10 | 36.20 | 13.75 | 664ab | 130 |
| $T_3$=BCX-91040-3 | 41.80 | 32.25 | 13.25 | 601bc | 130 |
| $T_6$=BARI Chola 5 | 45.35 | 36.95 | 14.13 | 719a | 130 |
| LSD (0.05) | NS | NS | NS | 87.83 | NS |
| CV (%) | 10.69 | 12.60 | 5.85 | 9.06 | 1.02 |

# ADVANCED YIELD TRAIL OF CHICKPEA IN THE HIGH BARIND TRACT


## Abstract

A field experiment was carried out in farmer's field at FSRD site, Chabbishnagar, Rajshahi during Rabi, 2002-2003 to evaluate the performance of promising BGM and wilt resistant lines. Nine advanced line of chickpea viz. BCX-91010-1, ICCV-98939, ICCV-98936, ICCV-94916-8, ICCX-5100206-2, ICCV-95138, ICCV 97004, BZX 910109-3, ICCV 96020 and two checks (BARI Chola-5 & ICCL 87322) were tested. The entry ICCV 97004 (1.55 t/ha) and ICCV 98936 (1.51 t/ha) produced the highest yield and significantly different from the check variety/line


## Introduction

Chickpea (*Cieer arietinum L*) is the third major pulse crop in Bangladesh (BBS.1997). It is one of the best grain legumes for human and animal consumption. It contributes about 20 percent of the total pulses (BBS, 1992). It is normally cultivated in the winter season on conserved soil moisture. Its average yield in Bangladesh is far below the yield level achieved by many other chickpea growing countries (BARC, 1975). The yield of chickpea is probably most unstable among pulses due to its more sensitivity to micro-environment conditions (Musa and Kar, 1995). On the other hand, it has got the highest yield potentiality under favourable environment. Such low yield might be attributed to the lack of high yielding and disease resistance varieties, inadequate fertilizer use and inappropriate cultural practices. Chickpea is found to be a very suitable under dry land rabi crop with residual soil moisture condition. Under Barind stress situation it can be successfully grown after harvesting of short duration T.aman rice. BGM and wilt is a major disease of chickpea production in Bangladesh. So, this present trial was initiated with the objective to select lines against BGM and wilt.

## Materials and Methods

The trial was conducted at FRSD site, Chabbishnagar Rajshahi during Rabi 2002-03. The experiment was laid out in a randomized block design with three replications. The unit plot size was 6 rows X 4 m. The seeds were sown in 40 cm row spacing with continuous sowing. Eleven advanced lines/varieties viz. BCX-91010-1, ICCV-98939, ICCV-98936, ICCV-94916-8, ICCX-5100206-2, ICCV-95138, ICCV 97004, BZX 910109-3, ICCV 96020, BARI Chola-5, ICCL 87322 were included in the study. Seeds were sown on 28 October 2002. The seed rate was maintained 50 kg/ha. The land was fertilized at the rate of 20-40-20 N, $P_2O_5$, $K_2O$ kg/ha in the form of urea, TSP and MP respectively. All fertilizers were applied as basal during the final land preparation. The crops were harvested on 18 March 2003. The seed yield and other related data were recorded and analyzed statistically.

## Results and Discussion

Days to flowering ranged from 78 to 82. The days to flowering differed among different lines. The entry ICCV 94916-8, ICCX 9100206-2 and BCX 910109-3 took maximum (82) and line ICCL 87322 (78) took the minimum number of days for flowering (Table 1). Days to maturity ranged from 116 to 126. The entry ICCV 95138 and ICCV 96020 took the maximum (126) and entry BCX-91010 1 (116) took the minimum number of days for maturity. The highest percentage of mortality was observed in the line ICCV 94916-8 (4.56%) and the lowest in ICCV 96020 (0%). Significantly the highest plant height was recorded in line ICCL 87322 and the lowest from line ICCX-9100206-2. The highest number of pods/plant was obtained from line ICCV-97004 which was significantly different from other lines and lowest from ICCL-87322. The highest 1000 seed weight was obtained from line ICCV-94916-8 (263.0 g) and lowest from ICCV-98939 (133.1g). Among eleven lines/variety, the highest seed yield (1.55 t/ha) was obtained from the line ICCV-97004 which was statistically identical to ICCV-9836 but superior over other check variety/lines. On the basis of mortality and yield performance, four entries ICCV-97004, ICCV-98936, BCX- 910109-3 and ICCV 989339 may be selected for further evaluation in the next year.

## Conclusion

From this study it was observed that some lines were promising for Barind area, however yield was low in comparison to potential yield. On the basis of mortality and yield performance, four entries ICCV 97004, ICCV-98936, BCX 910109-3 and ICCV 989339 may be selected for further evaluation in the next year.

Table 1. Performance of some advance lines of chickpea, Chabbishnagar, Rajshahi during 2002-03

| Entries | Days to flowering | Days to maturity | Plant poptn $m^{-2}$ | Mortality (%) | Plant height (cm) | Pods $plant^{-1}$ | Grain $pod^{-1}$ | 1000 seed wt.(g) | Seed yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| BCX-91010-1 | 79 | 116 | 29 | 1.47 | 56.40 | 49.27 | 1.40 | 155.0 | 1.08 | 2.48 |
| ICCV-98939 | 80 | 118 | 31 | 0.85 | 54.40 | 50.67 | 1.33 | 133.1 | 1.43 | 2.05 |
| ICCV-98936 | 81 | 120 | 34 | 1.45 | 55.40 | 54.33 | 1.46 | 139.3 | 1.51 | 2.29 |
| ICCV-94916-8 | 82 | 119 | 25 | 4.56 | 66.80 | 49.27 | 1.40 | 263.0 | 1.15 | 2.04 |
| ICCX-9100206-2 | 82 | 122 | 32 | 1.37 | 49.00 | 45.43 | 1.33 | 122.7 | 1.22 | 2.25 |
| ICCV-95138 | 81 | 126 | 31 | 0.44 | 61.73 | 46.00 | 1.33 | 243.3 | 1.39 | 1.91 |
| ICCV-97004 | 79 | 125 | 32 | 0.11 | 61.27 | 66.20 | 1.40 | 254.3 | 1.55 | 2.17 |
| BCX-910109-3 | 82 | 124 | 23 | 1.77 | 57.27 | 48.60 | 1.33 | 225.7 | 1.46 | 2.12 |
| ICCV-96020 | 81 | 126 | 24 | 00 | 60.07 | 43.87 | 1.33 | 254.7 | 1.36 | 2.25 |
| BARI Chola-5 | 79 | 122 | 31 | 0.16 | 59.73 | 55.87 | 1.46 | 136.3 | 1.31 | 2.20 |
| ICCL-87322 | 78 | 121 | 28 | 1.56 | 80.47 | 38.67 | 1.26 | 164.3 | 0.94 | 2.14 |
| LSD (0.05) | 4.81 | 4.62 | 4.05 | 0.37 | 9.11 | 7.90 | 0.18 | 21.23 | 0.15 | 0.33 |
| CV (%) | 3.5 | 2.06 | 8.28 | 17.60 | 8.86 | 9.11 | 7.98 | 6.59 | 6.44 | 8.82 |

# EFFECT OF SEED PRIMING ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF DIFFERENT CHICKPEA VARIETIES IN BARIND SOIL


## Abstract

An experiment was conducted in farmer's field at FSRD site, Chabbishnagor, Rajshahi during rabi season from November 2002 to March 2003 to study the effect of seed priming on yield and yield contributing character's of different chickpea varieties in Barind soil. Four levels of priming, (Control, 4 hours, 8 hours and 12 hours) and four different BARI released varieties of chickpea (BARI Chola-2, BARI Chola-3, BARI Chola-5 and BARI Chola-8) were used in this study. The result showed that priming seeds produced significantly higher yield than control (Non priming). Among the priming levels, 8 hours priming gave higher yield (1.22 t/ha) than control and other priming techniques. Chickpea yield was influenced by priming among the varieties. Combined effect of varieties and priming techniques, BARI Chola-5 gave better performance at 8 hours priming level and BARI Chola-8 gave better performance at 12 hours priming level.


## Introduction

Chickpea (*Cicer arietinum* L.) is the third most important pulse crop in Bangladesh in respect of area and production with and average yield of 765 kg/ha. Chickpea yield is probably the most unstable among the pulse grown in Bangladesh due to the extreme sensitivity to micro-environment conditions. The area and the productivity of chickpea are not encouraging due to lack of suitable cultivars, adverse and variable climatic conditions and various biotic stresses. In the high Barind Tract (HBT), a vast area of land remains fallow during the winter season and there is ample scope of growing chickpea in the area if appropriate management techniques are followed. Chickpea is a very suitable dry land winter crop that can grow well on residual soil moisture. In the water-stressed environment of HBT, it can be grown successfully after harvesting of short duration transplanted aman (t.aman) rice.

Barind region is dry land area, where crop establishment are affected if soil moisture less at the lime of sowing. But there is instance in other crops, that seed priming enhance germination and crop establishment under stress situation. Therefore, this study was undertaken to find out the effect of priming on yield and yield contributing characters of chickpea.

## Materials and Methods

The experiment was conducted at FSRD site Chabbishnagor, Rajshahi during Rabi season of 2002-2003. The treatments of the experiment comprised of four different seed priming techniques (Control, 4 hours, 8 hours and 12 hours) and four varieties of chickpea (BARI Chola-2, BARI Chola-3, BARI Chola-5 and BARI Chola-8). This experiment was laid out in a RCB design with 3 replications. The size of each unit plot was 4m x 3m. Nitrogen, phosphorus and potassium were applied as basal during final land preparation at the rate of 20 kg N, 40 kg $P_2O_5$ and 20 kg $K_2O$ per hectare in the form of Urea TSP and MP, respectively. Seeds were sown in the field on 01 November 2002. The seeds were sown in line sowing method and seed rate was maintained 50 kg/ha. The crop was harvested on 28 March 2002. Weeding and plant protection measures were done as and when required. Data were collected on different yield and yield components and analyzed statistically.

## Results and Discussion

Priming techniques had slightly affected on plant population, pods/plant, seed yield and straw yield (Table 1). Among four priming levels, 8 hour's priming produced higher number of plant (27) as well as higher yield (1.22 t/ha) compare to control and other priming techniques. It was observed that plant population, plant height, pods/plant, 1000 seed wt and grain yield were significantly influenced by varieties. The highest plant height (38.61cm) was observed in BARI Chola-3 than other varieties. BARI Chola-5 produced higher number of pods/plant (38.65) compared to other varieties. The highest 1000 seed weight (220.54 gm) was obtained from BARI Chola-8 and lowest (112.40) was in BARI

Chola-2. Among four varieties BARI Chola-5 produced slightly higher grain yield (1.12 t/ha) and the lowest by BARI Chola-2 and BARI Chola-8.

BARI Chola-5 produced higher number of plant population in control, 4 hours and 8 hours priming level but BARI Chola-8 produced higher number of plant population in 12 hours priming level. There was no significant difference in plant height, BARI Chola-5 produced higher number of pods/plant in all priming level than other varieties. BARI Chola-8 produced the highest 1000 seed weight in all priming level, which was followed by BARI Chola-3. There was a significant difference of grain yield and straw yield on combined effect. .BARI Chola-5 produced higher yield in the priming level of 4 hours, 8 hours and control due to its higher plant population. But only BARI Chola-8 produced higher yield (1.24 t/ha) in 12 hours priming level due to its higher number of plant population.

## Conclusion

From the above results discussion it was found that BARI Chola-5 gave better performance at 8 hours priming level and BARI Chola-8 gave better performance at 12 hours priming level due to its bigger seed size. The experiment should be continued for another year to observe the year variation.

Table 1. Interaction effect of priming level and varieties on yield and yield attributes of Chickpea at FSRD site, Chabbishnagor, Rajshahi during 2002-03

| Priming level | Variety | Plant pop$^n$/ m$^{-2}$ | Plant height (cm) | Pods plant$^{-1}$ | Seeds pod$^{-1}$ | 1000-seed wt (gm) | Seed yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| $P_1$ (Control) | BARI Chola-2 | 18.33 | 26.53 | 35.40 | 1.23 | 103.10 | 0.82 | 1.64 |
| | BARI Chola-3 | 23.33 | 25.73 | 36.66 | 1.13 | 172.50 | 1.08 | 2.01 |
| | BARI Chola-5 | 25.33 | 29.03 | 39.33 | 1.20 | 112.82 | 1.20 | 1.99 |
| | BARI Chola-8 | 24.33 | 26.73 | 38.90 | 1.33 | 218.50 | 0.97 | 1.86 |
| $P_2$ (4 hours) | BARI Chola-2 | 19.33 | 34.46 | 32.66 | 1.20 | 110.70 | 0.88 | 1.90 |
| | BARI Chola-3 | 24.00 | 35.66 | 32.66 | 1.26 | 167.71 | 1.05 | 2.00 |
| | BARI Chola-5 | 27.33 | 30.46 | 34.80 | 1.16 | 127.00 | 1.26 | 2.00 |
| | BARI Chola-8 | 26.00 | 33.86 | 33.53 | 1.17 | 212.30 | 1.15 | 2.21 |
| $P_3$ (8 hours) | BARI Chola-2 | 19.66 | 24.90 | 31.80 | 1.23 | 120.00 | 0.92 | 1.79 |
| | BARI Chola-3 | 24.30 | 25.83 | 34.30 | 1.36 | 171.32 | 1.21 | 2.11 |
| | BARI Chola-5 | 28.00 | 24.26 | 37.03 | 1.30 | 122.10 | 1.29 | 2.17 |
| | BARI Chola-8 | 26.00 | 27.06 | 35.53 | 1.30 | 220.50 | 1.08 | 2.02 |
| $P_4$ (12 hours) | BARI Chola-2 | 19.00 | 29.60 | 31.00 | 1.13 | 120.00 | 0.85 | 1.81 |
| | BARI Chola-3 | 22..66 | 28.66 | 33.50 | 1.12 | 181.42 | 1.01 | 1.98 |
| | BARI Chola-5 | 26.33 | 27.86 | 35.40 | 1.20 | 121.30 | 1.13 | 1.96 |
| | BARI Chola-8 | 28.33 | 27.87 | 32.70 | 1.20 | 220.54 | 1.24 | 2.25 |
| LSD (0.05) | | 3.21 | NS | 4.102 | NS | 5.51 | 0.14 | 0.23 |
| CV (%) | | 8.11 | 5.53 | 6.49 | 7.53 | 5.12 | 7.45 | 8.57 |

# ALTERNATIVE RAINFED RABI CROPS TO CHICKPEA FOR THE HIGH BARIND TRACT


## Abstract

An experiment was conducted at FSRD site, Chabbishnagar and MLT site, Nachole during Rabi season, 2002–2003. In this study, different rabi crops viz. Chickpea (BARI Chola3 and 5), Mustard (BARI Sharisa 9, 10, 11, Daulat and local), linseed, sunflower safflower, nizer, wheat, barley, cheena, lathyrus, & coriander were evaluated for selecting them as alternative crop (s) of chickpea under rainfed situations. Among the tested crops, chickpea was the best under rainfed conditions in both locations and the other potential and alternative rainfed Rabi crops may be linseed, barley and coriander for both location.


## Introduction

Chickpea (*Cicer arietiunum* L.) is the third most important pulse crop in Bangladesh. It is one of the best grain legumes for human and animal consumption. It contributes about 20% of the total pulse. It is normally cultivated in the winter season on conserved soil moisture. The yield of chickpea is probably most unstable among pulses due to its more sensitivity to micro-environment conditions. Continued cropping of chickpea on the same land leads to build up of soil-borne diseases of chickpea, particularly Fusarium wilt and collar rot (*Sclerotium rolfsii*) and consequent yield decline. The particular advantage of Chickpea is being able to grow on residual soil moisture in a post-rainy season because it has deep rooting behavior. It is possible to identify other crops (barley, linseed, coriander, lathyrus & millet) with similar characteristics and that are adapted to the environment of the rabi season to the High Barind Tract (HBT). It is, therefore, intended to evaluate the yield performance and profitability of a range of possible alternative rainfed crops to chickpea at several locations across the HBT.

## Materials and Methods

The experiment was conducted at FSRD site, Chabbishnagar, Godagari, Rajshahi (Southern HBT) and MLT site, Nachole, Nawabgonj (Central HBT) during Rabi 2002-2003. The tested crops were Chickpea (Var. BARI Chola-5), mustard (Var. Local, Daulat, BARI Sharisha-9, 10 & 11), linseed (Var. local), barley (BARI barley-2), wheat (Var. kanchan), coriander (Var. local), safflower (Var. local), sunflower (Var. kironi), nizer (Var. local) & Cheena (Var. tusher) at FSRD Site, Chabbishnagor and Chickpea (Var. BARI Chola-3 & 5), mustard (Var. Local), linseed (Var. local), barley (BARI barley-2), wheat (Var. kanchan), coriander (Var. local), safflower (Var. local), sunflower (Var. kironi), lathyrus (Var. local), lentil (Var. BARI mosur-4) & Cheena (Var. tusher) at MLT Site, Nachole, Nawabganj. The experimental site was high land of silty loam to silty clay loam soils, belonging to Amnura series of gray terrace soil (Agro-ecological zone # 26). The experiment was laid out in a randomized complete block design with 3 dispersed replication at each location. The unit plot size was 5m x 6m. The seeds were sown in hand broadcast followed by ploughing with power tiller and laddering. Seeds were sown on 15-20 November 2002 at FSRD site, Chabbishnagor and 16-18 November 2002 at MLT site, Nachole, Nawabgonj. The seed rate was maintained 50 kg/ha for chickpea, 40 kg/ha for lentil, 120 kg/ha for barley, 8 kg/ha for mustard, 30 kg/ha for coriander, 30 kg/ha for safflower, 8 kg/ha for linseed, 20 kg/ha for cheena (proso millets), 120 kg/ha for wheat, 50 kg/ha for lathyrus, 120kg/ha for barley. The land was fertilized at the recommended optimum fertilizer dose of different crops. All fertilizers were applied as basal during final land preparation. No irrigation was applied in the crop field. Hand weeding were done in two times at 21 DAS and 40 DAS, respectively. Malathion was sprayed @ 2 ml/L for Aphids of mustard & Lathyrus and Symbush was sprayed @ 2 ml/L for pod borer of chickpea. The crops were harvested on 10-15 February 2003 for mustard and 25 March to 5 April 2003 for other crops at FSRD site, Chabbishnagor. In Nachole MLT site, the crops were harvested on 10-12 February 2003 for mustard and 20-25 March 2003 for other crops. The seed yield and other related data were recorded and analyzed statistically.

## Results and Discussion

**Chabbisnagar, FSRD Site :** There was a distinct dry season from October to May (data not shown). The dry period affected the yield of wheat, mustard, lathyrus, sunflower, cheena, nizer and safflower. The performance of different rainfed Rabi crops were presented in Table1. The highest plant population $m^{-2}$ at one month were recorded in Nizer (184) where as it was 177 at maturity stage. The lowest number 11 was found in sunflower. In case of days to flowering, 75 days were required for nizer, whereas the lowest days to flowering (49) was need for linseed. On the other hand, chickpea and safflower had taken 130 days for maturity while days to maturity for local mustard was 84 days. The highest seed yield 1840 kg/ha was found in barley followed by wheat (1640) and the lowest yield (383) was recorded in Nizer. In case of chickpea equivalent yield, the highest yield (1070 kg/ha) was produced by chickpea followed by linseed (710 kg/ha) and the lowest (202 kg/ha) was recorded in safflower.

Cost and return was calculated and present in Table 3. The highest gross margin (21227 Tk/ha) was obtained form chickpea followed by coriander (12755 Tk/ha) and linseed (12315 Tk/ha). The lowest was found from wheat. The highest BCR (4.26) was given by chickpea followed by linseed (3.06) and coriander (2.59) and the lowest from wheat (1.44).

**Nachole MLT site:** The seed yield, biomass yield and Chickpea equivalent yield were calculated (Table-2). The highest plant population $m^{-2}$ at one month 146 were recorded in wheat whereas it was 142 at maturity stage. The lowest number 34 was found in chickpea at 1 month and it was 32 at maturity stage. In case of days to flowering, the highest 69 days were required for chickpea and safflower whereas the lowest days to flowering (45) was needed for linseed. On the other hand, chickpea and safflower had taken 129 days for maturity while local mustard took 87 days.

The highest seed yield 1560 kg/ha was found in barley followed by wheat (1350 kg/ha) and the lowest yield (410 kg/ha) was recorded from safflower. In case of chickpea equivalent yield, the highest yield (1080 kg/ha) was produced by chickpea cv. BARI Chola 5 followed by chickpea cv. BARI Chola 3 (1030 kg/ha) and the lowest (264 kg/ha) was obtained from lathyrus.

Cost and return was calculated and presented in Table4. The highest gross margin (Tk 21507/ha) was given by chickpea followed by linseed (Tk 10970/ha). The lowest was obtained from lathyrus (Tk 1390 /ha). The highest BCR (4.30 and 4.12) was obtained from chickpea followed by linseed (2.84) and lentil (2.46) and the lowest from lathyrus (1.24).

## Conclusion

Considering seed yield as well as cost and return analyses of different crops, Chickpea was found to be best crop under rainfed conditions in both the locations of HBT. Beside chickpea other potential rainfed crop may be linseed, barley and coriander in High Barind Tract. The experiment should be continued for the second year for conclusion.

### Farmers reaction

Farmers of both sites showed interest to cultivate barley, linseed and coriander for rotating with chickpea. However, farmers of Nachole keen interest to show the performance of lentil (as lentil grew in some pockets). They opined that in all cases market price of the products and seed availability would be the deciding factors.

Table 1. Performance of different alternative Rabi crops to chickpea for the High Barind Tract, Chabbishnagor during Rabi 2002-03

| Name of crops | Plant pop$^n$ at 1 month (no) | Plant pop$^n$ at maturity (no) | Days to flowering (no.) | Days to maturity (no.) | Seed yield (kg/ha) | Chickpea equivalent yield (kg/ha) | Biomass yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| **Pulse crop** | | | | | | | |
| Chickpea | | | | | | | |
| BARI Chola-5 | 42 | 39 | 73 | 130 | 1070 | 1070 | 1470 |
| **Oil crop** | | | | | | | |
| Mustard | | | | | | | |
| BARI sharisa 9 | 75 | 73 | 60 | 85 | 533 | 384 | 1440 |
| BARI sharisa 10 | 70 | 65 | 60 | 87 | 636 | 458 | 1850 |
| BARI Sharisa 11 | 90 | 84 | 70 | 95 | 620 | 446 | 2080 |
| Daulat | 95 | 89 | 70 | 95 | 570 | 410 | 1700 |
| Local | 82 | 76 | 67 | 84 | 490 | 353 | 2110 |
| Linseed (Nila) | 110 | 108 | 49 | 100 | 710 | 710 | 1170 |
| Sunflower (Kironi) | 11 | 11 | 65 | 110 | 1040 | 416 | 5080 |
| Safflower (Local) | 51 | 48 | 71 | 130 | 420 | 202 | 2010 |
| Nizer | 184 | 177 | 75 | 110 | 383 | 230 | 787 |
| **Cereal crop** | | | | | | | |
| Wheat (Kanchan) | 156 | 147 | 65 | 117 | 1640 | 525 | 2120 |
| Barley (BARI barley-2) | 144 | 132 | 68 | 123 | 1840 | 589 | 2700 |
| Cheena (Tussar) | 220 | 216 | 61 | 121 | 840 | 253 | 2560 |
| **Spices crop** | | | | | | | |
| Coriander (Local) | 145 | 138 | 63 | 120 | 810 | 648 | 1180 |

Table 2. Performance of different alternative Rabi crops to chickpea for the High Barind Tract at Nachole MLT site during Rabi 2002-03

| Name of crops | Plant population at 1 month (no.) | Plant population at maturity (no.) | Days to flowering (no.) | Days to maturity (no.) | Seed yield (kg/ha) | Chickpea equivalent yield (kg/ha) | Biomass yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| **Oil crops** | | | | | | | |
| Linseed (Local) | 107 | 105 | 45 | 92 | 650 | 650 | 1380 |
| Mustard (local) | 92 | 90 | 68 | 87 | 460 | 331 | 2140 |
| Safflower (Local) | 49 | 48 | 69 | 129 | 410 | 164 | 2140 |
| **Cereal crops** | | | | | | | |
| Barley (BARI barly-2) | 130 | 125 | 65 | 123 | 1560 | 492 | 2270 |
| Wheat (Kanchan) | 146 | 142 | 62 | 114 | 1350 | 432 | 2030 |
| **Pulse crops** | | | | | | | |
| Lentil(BARI Mosur-4) | 140 | 102 | 68 | 116 | 790 | 790 | 1160 |
| Lathyrus (Local) | 107 | 85 | 62 | 127 | 440 | 264 | 1360 |
| Chickpea (BARI Chola-5) | 43 | 41 | 69 | 128 | 1080 | 1080 | 2030 |
| Chickpea (BARI Chola-3) | 34 | 32 | 70 | 129 | 1030 | 1030 | 2100 |
| **Spices crops** | | | | | | | |
| Coriander (Local) | 110 | 102 | 60 | 124 | 680 | 544 | 1420 |

Table 3. Cost and return analysis of different alternative Rabi crops to chickpea for the High 2002-03

| Name of crops | TVC(Tk/ha) | | GR(Tk/ha) | | GM(Tk/ha) | | BCR | |
|---|---|---|---|---|---|---|---|---|
| | $L_1$ | $L_2$ | $L_1$ | $L_2$ | $L_1$ | $L_2$ | $L_1$ | $L_2$ |
| **Pulse crops** | | | | | | | | |
| Chickpea (BARI Chola-5) | 6508 | 6508 | 27735 | 28015 | 21227 | 21307 | 4.26 | 4.30 |
| Chickpea BARI Chola 3 | - | 6508 | - | 26800 | - | 20292 | - | 4.12 |
| Lentil (BARI Masur-4) | - | 6780 | - | 17930 | - | 10950 | - | 2.46 |
| Lathyrus (local) | - | 5840 | - | 7230 | - | 1390 | - | 1.24 |
| **Oil crops** | | | | | | | | |
| Mustard | | | | | | | | |
| BARI sharisa 9 | 7850 | - | 9594 | - | 1744 | - | 1.22 | - |
| BARI sharisa 10 | 8200 | - | 11448 | - | 3248 | - | 1.40 | - |
| BARI Sharisa 11 | 8550 | - | 11160 | - | 2610 | - | 1.31 | - |
| Daulat | 8000 | - | 10260 | - | 2260 | - | 1.28 | - |
| Llocal | 7605 | 7605 | 9930 | 11220 | 2325 | 3605 | 1.31 | 1.48 |
| Linseed (Nila) | 5970 | 5970 | 18285 | 16940 | 12315 | 10570 | 3.06 | 2.84 |
| Sunflower | 8160 | - | 10400 | - | 2240 | - | 1.27 | - |
| Safflower (Local) | 4030 | 4030 | 5735 | 5490 | 1705 | 1480 | 1.42 | 1.36 |
| Nizer | 3995 | - | 5745 | - | 1750 | - | 1.44 | - |
| **Cereal crops** | | | | | | | | |
| Wheat (Kanchan) | 8060 | 8060 | 9622 | 11815 | 1562 | 3755 | 1.19 | 1.47 |
| Barley (BARI barley-2) | 8040 | 8040 | 19750 | 16735 | 11710 | 8695 | 2.46 | 2.08 |
| Cheena | 5740 | - | 7355 | - | 1615 | - | 1.28 | - |
| Coriander (Local) | 8015 | 8015 | 20760 | 17560 | 12755 | 9545 | 2.59 | 2.19 |

$L_1$ = Chabisnagar TVC = Total variable cost GR = Gross return
$L_2$ = Nachole GM = Gross margin BCR = Benefit cost ratio

**Market price of seed/ grain:**

Chickpea = Tk. 25 $kg^{-1}$ Nizer = Tk. 15 $kg^{-1}$
Mustard = Tk. 18 $kg^{-1}$ China = Tk. 9 $kg^{-1}$
Wheat = Tk. 8 $kg^{-1}$ Coriander = Tk.25 $kg^{-1}$
Linseed = Tk. 25 $kg^{-1}$
Barley = Tk. 11 $kg^{-1}$
Sunflower = Tk. 10 $kg^{-1}$
Safflower = Tk. 14 $kg^{-1}$
Barley = Tk. 11 $kg^{-1}$

# IDENTIFICATION OF FACTORS LIMITING THE YIELD OF CHICKPEA


## Abstract

A study was conducted at FSRD site, Chabbishnagar, Rajshahi during 2001-2002 to determine the factors limiting the high yield of chickpea in order to identify the causes of yield gap between farmers field and research. In this study 12 treatments combinations were used following principle of omission of a single factor from a set of optimum packages of practices. On an average results showed the highest yield was obtained from seed sowing on 1-7 November combined with seed rate 40 kg $ha^{-1}$ (broadcast), 20 kg $P_2O_5$ $ha^{-1}$ and disease & pest control as and when necessary.


.

## Introduction

Chickpea occupies a unique position in the world agriculture by virtue of its high seed protein content and capacity to restore soil fertility through symbiotic nitrogen fixation. Chickpea ranks fifth in terms of acreage and production of pulses in Bangladesh. However, the potential yield of chickpea is 2 t/ha in Bangladesh if the full package of production is followed. But there is a reduction of seed yield at farmer's field. Some of the causes of low yields were related with environmental conditions and better agronomic practices. Therefore, this study will be taken to identify the factors limiting the high yield of chickpea following the principle of omission of a single factor from a set of optimum package of practices. Therefore, the experiment was undertaken to find out the yield gap between farmer’s field and research station.

## Materials and Methods

The experiment was conducted at FSRD site, chabbishnagar, Rajshahi during 2001-02 and 2002-03. RCB design with 3 replications was followed in the study. Treatment combinations of the study were:-

$T_1$= Complete package (CP): Sowing seed on 1-7 November for Barind + recommended variety (var. BARI Chola-5 + recommended seed rate 40 kg/ha (line sowing 30 cm x 5cm) + seed treatment with 3 g. Vitavax kg/ha seed + fertilizers @ 20 kg N, 40 kg $P_20_5$, 30 kg $K_20$, 20 kg S and I kg B/ha + disease and insect control (pre-sowing irrigation for germination if needed), $T_2$ = CP but sowing seeds on 25-30 November for Barind, $T_3$ = CP omission of chemical fertilizers, $T_4$ = CP with cowdung @ 5 t/ha but omission of chemical fertilizer, $T_5$ = CP with inoculum instead of N fertilizer (only N fertilizer omission), $T_6$ = CP with seed rate @ 30 kg/ha (instead of 40-45 kg/ha), $T_7$ = CP omission of seed treatment by Vitavax, $T_8$ = CP omission of disease and insect control, $T_9$ = Farmers practices (FP): Sowing seeds on 1-7 November + seed rate 40 kg/ha (Broadcast) + fertilizer 20 kg $P_20_5$ + disease and insect control, $T_{10}$= FP omission of disease and insect control, $T_{11}$= CP with seed soaking for 8 hrs in waterlogged conditions before sowing (sowing time like $T_1$), $T_{12}$= CP with seed soaking for late sowing (sowing time like $T_2$).

But in second year (2002-03) following treatment combinations were selected on the basis of first year performance which were; $T_1$, $T_2$, $T_3$, $T_5$, $T_7$, $T_9$ and $T_{11.}$

Seed treatment, sowing method of seed, seed rate, sowing time of seed, fertilizer dose, disease and pest control in the study were followed as per treatment. All fertilizers were used as basal before final land preparation. The unit plot size was 3m x 4m. The crops were harvested on 21 March 2002 and 15 April 2003. Data on yield and yield attributes were collected and analyzed statistically.

## Results and Discussion

Plant height, pods/plant, seeds/pod, 100 seed weight, seed yields were significantly affected by different treatment but plant/$m^2$ was use unaffected (Table 1). Treatment $T_6$ showed higher no. of pods/plant but statistically at par to treatment $T_1$, $T_4$ and $T_5$. Seed/pod showed the highest but at par to all treatment except treatment $T_5$ & $T_7$. Higher seed yield was recorded from treatment $T_9$ but statistically identical to $T_1$, $T_3$, $T_5$ & $T_7$. On an average higher seed yield was recorded from treatment $T_9$ i.e. farm practice sowing seeds on 7-11 November, 40 kg seeds/ha, fertilizer 20 kg $P_2O_5$ and disease insect control.

Table 1. Yield and yield attributes of chickpea as affected by different factors (Barind, 2002-03)

| Treatment | Plant height (cm) | Plant/ $m^2$ | Pods/ plant | Seeds/ pod | 100- seed wt (g) | Straw yield (t/ha) | Seed yield (t/ha) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2002-03 | 2001-02 |
| $T_1$ | 34.67a | 37.33 | 39a | 1.87a | 12.72ab | 1.66a | 1.35a | 1.16ab |
| $T_2$ | 27.53c | 31.33 | 27b | 1.60ab | 12.06abc | 0.98b | 0.83b | 0.63c |
| $T_3$ | 30.47bc | 35.67 | 27b | 1.60ab | 11.0c | 1.32ab | 1.28a | 1.0a-c |
| $T_4$ | - | - | - | - | - | - | - | 0.86a-c |
| $T_5$ | 33.87ab | 32.67 | 38a | 1.47ab | 11.60a-c | 1.43ab | 1.22a | 1.16ab |
| $T_6$ | - | - | - | - | - | - | - | 0.98a-c |
| $T_7$ | 29.65c | 32.67 | 37a | 1.33b | 11.27c | 1.33ab | 1.23a | 0.97a-c |
| $T_8$ | - | - | - | - | - | - | - | 0.68c |
| $T_9$ | 34.48a | 38.67 | 39a | 1.83a | 13.05a | 1.60a | 1.44a | 1.25a |
| $T_{10}$ | - | - | - | - | - | - | - | 0.72bc |
| $T_{11}$ | 29.93c | 32.0 | 29b | 1.33b | 12.33a-c | 1002b | 0.90b | 1.0a-c |
| $T_{12}$ | - | - | - | - | - | - | - | 0.65c |
| LSD(0.05) | 3.61 | NS | 6.85 | 0.39 | 1.32 | 0.47 | 0.26 | 0.40 |
| CV(%) | 6.44 | 10.05 | 11.47 | 13.79 | 6.18 | 19.74 | 12.16 | 26.43 |

# STUDY ON THE SEED ENRICHMENT OF MUSTARD WITH BORON TO MINIMIZE BORON DEFICIENCY IN THE SOIL


## Abstract

The study was conducted at FSRD site, Chabbishnagar, Rajshahi during rabi season 2002-03 with the objective to get boron enriched seeds which can be grown in boron deficient soil without boron application The experiment involved 5 levels of boron viz 3 levels of foliar spray @ 50, 100 and 200 mg/litre, soil application @ 1.00 kg/ha and control. Seed yield and yield attributes varied significantly among different levels of boron. The highest seed yield (1.52 t /ha) was obtained from foliar spray of boron @ 200 mg/litre due to combined effects of the highest number of effective siliqua /plant, the lowest number of sterile siliqua/plant, the highest number of seeds/siliqua and the heaviest seed weight. No application of boron gave the lowest seed yield (0.96 t/ha).


## Introduction

Mustard is one of the major oil crops in Bangladesh. Bangladesh imported mustard seeds 100,890 metric tons with about Tk.127 crore in the year 1997. But seed yield is very low compared to other mustard growing countries of the world. The seed yield of mustard is greatly influenced by boron (B) particularly where soil is B deficient. The soil analysis revealed that the soil of High Barind area contains trace amount (0.14-0.33 mg/g soil) of boron. Sterility in Mustard is an important constraint for low yield due to boron deficiency. Experimental reports suggest that application of boron has significant effect in reducing sterility. Boron also essential for bearing fruits. Farmers generally do not use boron in the field .Due to deficiency of Boron plant growth is stunted and leaves become curling. Foliar application of Boron is beneficial for quick recovery of the crop. With this mind, the experiment was undertaken to find out the effect of seed environment of mustard with born.

## Materials and Methods

The trial was conducted at FSRD site, Chabbishnagar, Rajshahi during rabi season in 2002-03. The experiment was laid out in a randomized complete block design with four replications. The unit plot size was 5m x 4 m. The seeds (8 kg $ha^{-1}$) were sown in 30cm row spacing with continuous sowing. The seeds were sown on 7 November 2002. The test variety was BARI sharisa8 (*Brassica napus*). Nitrogen, phosphorus, potassium and sulphur were applied as basal during final land preparation at the rate of 120-35-60-30 kg/ha in the form of urea, Triple super phosphate, Muriate of potash and Zypsum, respectively. The treatment combinations of the study were :

$T_1$= Foliar spray of Boron @ 50 ppm i.e. 50mg/litre
$T_2$= Foliar spray of Boron @ 100 ppm i.e. 100mg/litre
$T_3$= Foliar spray of Boron @ 200 ppm i.e. 200mg/litre
$T_4$= Soil application of Boron @ 1.00 kg/ha
$T_5$= Control

Spray was done 3-5 days before initiation of flowering. The crop was harvested on 8 February 2002. Data were collected on different yield components and yield, analyzed statistically and the differences between treatment means were evaluated by LSD test.

## Results and discussion

Significant variation was observed in yield and yield attributes affected by different level of boron application except plant height, plant/$m^2$ and biomass yield (Table 1). Higher number of effective siliqua /plant was found in $T_3$ which was statistically identical to $T_4$ and $T_2$. The lowest number of siliqua/plant was obtained from $T_5$ which was identical to $T_1$. On the other hand, the highest number of sterile siliqua was observed in $T_5$ and the lowest in the treatment $T_3$. Treatment $T_3$, $T_4$ & $T_2$ showed similar number of seed/siliqua & higher than other treatment. Similar trend was noted in case of seed weight. Higher seed yield was recorded from treatment $T_3$ but statistically at par to $T_4$ treatment.

From one year result it showed that boron fertilizer may be applied 200 mg/litre as foliar spray for higher yield of mustard. The experiment need another year trial for confirmation.

Table 1. Effect of boron application on the yield and yield contributing characters of mustard, HBT, Rajshahi, 2002-03

| Treatment | Plant height (cm.) | Plant population /m$^2$ (No.) | Effective siliqua/ plant (No.) | Sterile siliqua /plant (No.) | Seed/ siliqua (No.) | 1000 seed wt. (g) | Seed yield (t/ha) | Biomass yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | 98.03 | 57.50 | 72.48 | 7.60 | 16.93 | 2.35 | 1.03 | 3.03 |
| $T_2$ | 101.93 | 58.71 | 86.90 | 6.85 | 20.07 | 3.06 | 1.17 | 3.41 |
| $T_3$ | 102.23 | 59.92 | 92.52 | 5.45 | 20.85 | 3.11 | 1.52 | 3.57 |
| $T_4$ | 103.33 | 60.36 | 92.40 | 6.90 | 20.52 | 3.11 | 1.42 | 3.26 |
| $T_5$ | 96.18 | 50.96 | 69.12 | 10.38 | 13.97 | 2.13 | 0.96 | 3.16 |
| LSD(.05) | NS | NS | 8.58 | 1.61 | 2.92 | 0.46 | 0.304 | NS |
| CV (%) | 4.10 | 8.37 | 6.74 | 14.08 | 10.28 | 10.78 | 16.13 | 14.08 |

# EFFECT OF SOWING TIME ON THE YIELD AND YIELD ATTRIBUTES OF BARLEY IN HIGH BARIND TRACT


## Abstract

The experiment was conducted in farmer's field at Chabbishnagar, Godagari, Rajshahi during rabi season of 2001-2002 and 2002-2003 to find out the appropriate time of sowing and suitable variety of barley. Three sowing dates (30 November, 15 December and 30 December) and three barley varieties (BARI barley 1, BARI barley 2 and Local) were included in the study. In general grain and straw yields increased with early sowing (30 November.) for all the three varieties in both the years. The results showed that BARI barley1x November 30 sowing gave the highest grain yield, however it was at par with BARI barley-2 x November 30 sowing and BARI barley1 x December 15 sowing. Hence BARI barley1 could be sown within the range of November 15 to December 15, while BARI barley2 would be planted within November 15.


## Introduction

A vast area of High Barind Tract remains fallow after harvesting of T.aman due to lack of soil moisture. Organic matter and essential fertilizer elements are below under critical level. The Barind farmers have already started chickpea cultivation in such type of land. Scientist observation report showed that, Chickpea yield could be deteriorated if the same land is continuously used for 3 years or more and disease infestation specially wilt outbreak would probably be more. So, alternative crop is needed for crop rotation of chickpea field. Barley may be one of the alternative crop for chickpea As, barley is also a deep rooted crop (105cm penetration into soil) like chickpea. However, time of planting might has an important role for getting a reasonable yield. Therefore, it is pertinent to study the effect of sowing time on the performance of barley varieties in High Barind Tract area.

## Materials and Methods

The experiment was carried out under rainfed condition at FSRD site Chabbishnagar, Rajshahi during Rabi season 2001-2002 and 2002-2003. The soil belongs to Amnura series having silty clay loam texture. The land was prepared by two ploughing and cross ploughing followed by laddering. At the time of final land preparation, fertilizers were applied at the rate of 85 - 25 - 45 kg NPK $ha^{-1}$ in the form of urea, TSP, MP respectively, as basal dose. The treatments comprised of three different sowing time (i.e. $S_1$=30 November, $S_2$=15 December and $S_3$=30 December) and three barley varieties (i.e. $V_1$=BARI barley 1, $V_2$=BARI barley 2 and $V_3$=local). Seeds were sown @ 120 kg $ha^{-1}$ in lines at 20cm with continuous sowing. The experiment was laid out in a factorial randomized complete block design (2 factor experiment) with three replications. The unit plot size was 4m x 5m. Intercultural operations like weeding etc. were done as and when necessary. The crops were harvested at maturity stage. The data were collected on different yield components and yield and analyzed statistically.

## Results and Discussion

Grains/spike, grain yield and straw yield were significantly influenced by sowing date and variety but plant height and plant/$m^2$ and grain weight were statistically at par. Grains/spike decreased with the advancement of days from 30 November to 30 December. Grain yield showed the highest from 30 November sowing with BARI barley 1 but statistically identical to 15 December and 30 November sowing of BARI barley 2. There was trend to decrease yield from 15 December sowing to onward and the lowest yield from 30 December with local variety. Similar trend was followed in 2001-02. Significantly the highest straw yield was recorded from 30 November sowing of BARI barley-1 variety. On an average higher grain yield was obtained from 30 November sowing with variety BARI barley-1.

## Conclusion

From above result it may be concluded that BARI barley 1 gave superior yield when sown earlier (30 November) and it also produced good yield up to 15 December sowing while BARI barley-2 gave good yield only up to November 30 sowing.

Table 1. Interaction effect of different sowing time and varieties on yield and yield components of barley during Rabi 2002-03

| Treatment combination | | Plant height (cm) | Plant population (no.m-$^{2}$) | Grains spike$^{-1}$ (no.) | 1000-grain wt.(g) | Grain yield (t ha$^{-1}$) | | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| Sowing time | Variety | | | | | 2002-03 | 2001-02 | |
| $S_1$ | $V_1$ | 84.67 | 167.66 | 41.20a | 37.89 | 2.41a | 2.68a | 4.25a |
| | $V_2$ | 77.20 | 179.67 | 40.46a | 38.25 | 2.22ab | 2.61ab | 3.59bc |
| | $V_3$ | 79.87 | 174.33 | 39.04a | 35.25 | 1.75cd | 2.20c | 3.55d |
| $S_2$ | $V_1$ | 80.20 | 171.67 | 38.95a | 35.57 | 2.29a | 2.50ab | 3.98b |
| | $V_2$ | 85.23 | 218.00 | 39.25a | 36.95 | 1.98bc | 2.45b | 3.94bc |
| | $V_3$ | 81.86 | 184.67 | 38.00ab | 35.92 | 1.65d | 1.87d | 3.68c |
| $S_3$ | $V_1$ | 81.73 | 190.33 | 38.73a | 36.69 | 1.62d | 1.75d | 3.75d |
| | $V_2$ | 83.67 | 176.67 | 35.87ab | 35.99 | 1.50d | 1.83d | 3.60d |
| | $V_3$ | 79.27 | 164.00 | 32.29a | 33.68 | 1.22c | 1.29e | 3.21c |
| CV (%) | | 6.74 | 13.00 | 8.43 | 7.25 | 5.75 | 5.35 | 3.21 |

**(Hill Farming)**

# ADAPTIVE TRIAL OF DIFFERENT NEW VARIETIES OF POTATO IN HILLY AREAS AT BANDARBAN


## Abstract

An adaptive trial of different 8 varieties/lines of potato viz.: Raja, Heera, Deera, Diamont, Cardinal, BARITPS-1, 364/67 and Local one was carried out in hill valleys at Bandarban during rabi season 2002-03. Among these varieties, Heera produced the highest yield of 20.18 t/ha followed by Raja. The gross margin (Tk. 95109/ha) and BCR (2.43) were the highest from variety Heera. Comparatively the yield (16 t/ha) performance of local variety was also good.


## Introduction

Potato is widely cultivated throughout the year. It is an important vegetable crop in this area. But the area of this crop is limited due to abundant of hill. In Bandarban district about 2308 acres of land under potato cultivation with national average yield 13.8 t/ha. Maximum farmers are cultivated local variety called Dohajhari variety. It has an opportunity to increase per hectare yield of potato by introducing high yielding variety and scientific management to the farmers level. So, an adaptive trial of different new varieties of potato is undertaken at hilly areas of Bandarban.

## Materials and Method

The experiment was conducted at hill valley at Bandarban during rabi season 2002-03. Six varieties (Raja, Heera, Dheera, Diamont, Cardinal, BARI TPS-1) and one line (364/97) and local was included. The design was randomized complete block design with two replications. The unit plot size was 4 x 3.3 m with spacing 40 x 25 cm. The fertilizer dose was 150-30-120 NPK kg/ha. The experiment was sown from 18 November- 4 December 2002 and harvested 18 February- 1 March 2003.

## Results and Discussion:

Screening of different varieties/lines of potato was carried out at hill valleys in Bandarban Sadar during 2002-03.The results revealed that the variety of Heera produced higher yield of 20.18 t/ha (Table 1). Other variety of potato viz. Dheera gave 15.21, Raja,18.96, Diamont,12.48, cardinal, 14.38, BARI TPS-1,15.67, line 364/67,10.96 and local, 16.0 t/ha. The gross margin was found the highest Tk.95109/ha for Heera and the lowest was Tk. 21349/ha for the line of 364/67. The Benefit Cost Ratio was found the highest 2.43 for Heera and lowest 1.32 for the line of 364/67 (Table1). It has been observed that yield of all variety was comparatively lower than on-station research result due to late sowing (4.12.03) and prevalent of early blight disease. From this trial it is observed that potato cultivation can be possible for this limited area. If it is possible to cultivate in the early November the yield might be better than the observed yield trial. Comparatively the yield performance of local variety was also good. So, it has an opportunity to develop local variety due to farmer preference. The experiment needs to be repeated another year.

## Conclusion

Potato could be cultivated in the earliest time than farmers can get additional benefit from their higher yield. Potato seed supplied should be ensuring as the earliest time to the farmers level. Program should be undertaken to develop local variety according to farmer preference.

**Farmers reaction**

Farmers are very much interested to cultivate high yielding variety of potato but seed is not available there.

Table1. Screening trial of 8 varieties/lines of potato in hill valleys in Bandarban, 2002-03

| Variety/lines | Plant height (cm) | Tuber/ hill (No.) | Tuber yield (t/ha) | Skin colour | TVC (Tk/ha) | GR (Tk/ha) | GM (Tk/ha) | BCR |
|---|---|---|---|---|---|---|---|---|
| Raja | 19.1 | 10.5 | 18.96 | R | 66331 | 151680 | 85349 | 2.28 |
| **Heera** | 26.3 | 9.6 | **20.18** | W | 66331 | 161440 | **95109** | **2.43** |
| Dheera | 36.5 | 6.2 | 15.21 | W | 66331 | 121680 | 55349 | 1.83 |
| Diamont | 21 | 8.2 | 12.48 | W | 66331 | 99840 | 33509 | 1.50 |
| Cardinal | 25.8 | 7.7 | 14.38 | R | 66331 | 115040 | 48709 | 1.73 |
| BARI TPS-1 | 25 | 5.9 | 15.67 | W | 66331 | 125360 | 59029 | 1.88 |
| 364/67 | 43.5 | 15.1 | 10.96 | W | 66331 | 87680 | 21349 | 1.32 |
| **Local** | 35.5 | 16.96 | **16.00** | R | 66331 | 128000 | **61669** | **1.92** |

TVC= Total variable cost, GR= Gross Return, GM = Gross Margin (GR-TVC), R= Red & W= White

Price of potato: Tk. 8.00/kg

# ON-FARM EVALUATION OF SWEET POTATO VARIETIES DEVELOPED BY BARI AT HILL VALLEYS IN BANDARBAN


## Abstract

On-farm evaluation trial of sweet potato varieties viz. Kamalasunduri, BARI SP-4 and Local were carried out in hill valleys in Bandarban Sadar during 2002-03.The experiment revealed that Kamalasundari gave the highest yield 31.03 t/ha followed by BARI SP-4, 22.50 ton/ha and local 19.11 t/ha. According to the profitability, the same trend was found to net benefit Tk.91,132/ha for Kamalasundari , Tk 52747/ha and Tk 28501/ha for local variety. Benefit Cost Ratio was found 2.9, 2.0 and 1.7 for Kamalasundari, BARI SP-4 and Local, respectively.


## Introduction

In Bandarban district, sweet potato grows well in hill valleys. About 385 acres area covered by sweet potato with average national yield 12.8 ton/ha in Bandarban district. Farmers are growing local variety. Recently, BARI has developed some new varieties of sweet potato. It is necessary to identify the suitable variety for this area, an adaptive trial has been undertaken with the objective to identify the yield performance of different varieties of sweet potato.

## Materials and Methods

The experiment was conducted at Hill valley of Bandarban during 2002-03. Three varieties Kamalasunduri, BARI SP-4 and Local were included in the study. The experiment was carried out in randomized block design with three replications. The unit plot size was 5 x 2 m with spacing 60 x 30 m. The fertilizer dose was 119-92-57 kg N-P-K/ha. The crop was sown from 27-28 October, 2002 and harvest 3-7 March, 2003.

## Results and Discussion

The result of this trial has been presented in Table1.It was observed from the table that the highest yield (31.03 t/ha) was found from Kamalasundari followed by BARI SP-4 (22.50 t/ha) and local variety (19.11 t/ha). According to local market price (Tk.4.5/kg tuber) the highest net benefit was found Tk.91132/ha from Kamalasundari, followed by Tk.52747/ha for BARI SP-4 and Tk.28501/ha for local variety with Benefit Cost Ratio was found 2.9, 2.0 and 1.77, respectively. Time consumption of boiling were recorded as 19, 23 and 27 minute for Kamalasundari, BARI SP-4,and local, respectively.

### Farmer reaction

Farmers are agreed to grow new varieties of sweet potato, but vine are not available there. Farmers are highly appreciated Kamalasundari in respect of higher yield, profitability, colour, softness, minimum time consumption for boiling etc.

Table1. Yield Performance of Sweet potato varieties developed by BARI in Hill Valleys in Bandarban.

| Variety | No. of root/plant | Root wt. /plant (kg) | Tuber yield (t/ha) | GR (Tk./ha) | TVC (Tk./ha) | GM (Tk./ha) | BCR |
|---|---|---|---|---|---|---|---|
| **Kamalasundari** | 6.2 | 1.512 | **31.03** | 139635 | 48503 | 91132 | **2.9** |
| BARI SP-4 | 3.4 | 0.693 | 22.50 | 101250 | 48503 | 52747 | 2.0 |
| Local | 3.0 | 0.527 | 19.11 | 85999 | 48503 | 28501 | 1.77 |

GR=Gross return, TVC= Total variable cost, GM= Gross margin(GR-TVC), Market price @Tk4.5/kg tuber

# ON-FARM ADAPTABILITY TRIAL OF SOME PROMISING RAPE MUSTARD VARIETIES/LINES


## Abstract

The experiment was conducted in medium high land at FSRD site of Palima Tangail, Ishan Gopalpur, Faridpur, Golapganj, Sylhet, MLT site Magura, Norail & Kushtia, and ARS, Bogra, during rabi 2001-03 and Joypurhat, Nandigram, Narhatta, Gabtali and Jamalpur during 2002-03 to evaluate the performance of some promising variety/lines of rape mustard seeds under farmer's field condition. From the above result it showed that BARI Sarisha-11 and BARI sharisah-8 at Tangail, BARI Sarisha-7 at Faridpur, BARI Sarisha-11 at Sylhet, BARI Sarisha-8 at Magura, PT-303 at Norail, BARI Sarisha-6 or BARI Sarisha-11 or BARI Sarisha-8 at Kushtia and Ishurdi local at Bogra, Ishurdi local at Joypurhat, Nandigram, BARI sharia-8/7 at Narhatta and BARI Sarisha-8 and Rai-5 at Gabtali is found suitable for mustard but this need further trial for confirmation. The experiment needs to repeat at later four sites.


## Introduction

Bangladesh has to import huge amount of vegetable oil and oil seed every year to meet up the deficiency. Mustard is the major oil seed crop in Bangladesh. It covered about 70% 0f the total oil seed production of Bangladesh. The yield of this crop in Bangladesh is found much lower than the other countries due to yield potential of local varieties and its poor management practices. Oil Seed Research Center (ORC) of BARI has developed some advanced promising varieties/lines of rape-mustard which possess the high yield and less diseases susceptible and high oil content (44%). Hence, the study was undertaken to evaluate the performance of new line/variety under farmer's field condition.

## Materials and Methods

The trial was conducted at FSRD site, Palima, Tangail, Ishan Gopalpur, Faridpur, Golapganj, Sylhet, MLT site, Norail, Magura, Kushtia and ARS, Bogra during rabi 2001-03 and Joypurhat, Nandigram, Narhatta, Gabtali and Jamalpur during 2002-03 in farmer's field. The design of the experiment was RCBD with three replications. Tested cultivars were BARI Sarisha-6, BARI Sarisha-7, BARI Sarisha-8, BARI Sarisha-9 BARI Sarisha-10, Jamalpur-1, Ishurdi local, Rai-5, PT-303, TS-72, SS-75, Daulat and Tori-7. Plot size was 6 m × 4 m. Seeds were sown on 11 Nov., 5 Nov., 7 Nov., 17 Nov. & 5 Nov. at Faridpur, Sylhet, Jessore (2 sites) and Kushtia, respectively with a spacing of 30 cm × 6 cm. Fertilizer doses were 120-80-60-40-4-2 kg NPKSZnB/ha. All fertilizers were applied as basal except urea. Urea was applied as top dress on 20 and 45 days after sowing (DAS), respectively. One weeding cum thinning was done on18 DAS. The crops were harvested variety wise during January 26 to Febuary12, 29 Jan. to 12 Feb., 25 March at Tangail, Faridpur and Sylhet. The data on different plant characters and yield components were collected from 10 plants selected at random in each plot and yield was recorded plot wise. Data were analyzed statistically using MSTATC package.

## Results and Discussion

### FSRD site, Palima, Tangail

Growth duration, plant/m$^2$, plant height, yield and yield attributes were significantly influenced by different variety/line. The result showed that short duration variety identified was Tori-7, PT-303, TS-72, BARI Sarisha-9 & BARI Sarisha-12 medium duration was BARI Sarisha-6, Daulat and BARI Sarisha-8 and rest were BARI Sarisha-10, BARI Sarisha-7, SS-75, Jamalpur-1, Ishurdi local, Rai-5 and Daulat, respectively. Significantly the highest plant height was observed from Rai-5 whereas shorter height was shown in variety BARI Sarisha-7 and Tori-7. The variety TS-72 showed significantly the highest number of branch/plant. Number of pod/plant revealed higher from variety Rai-5 which was statistically differ from other variety. The variety TS-72 and SS-75 showed the highest number of seeds/pod, which was significantly different from other variety/line. BARI Sarisha-11, showed significantly the highest grain weight and bolder in size than the other variety. Among the varieties, BARI Sarisha-11, Daulat & BARI Sarisha-8 revealed statistically similar grain yield and showed higher yield than other variety. The variety SS-75, Tori-7 and BARI Sarisha-6 showed similar and the lowest grain yield. On an average the highest grain yield was obtained from BARI Sarisha-11 followed BARI Sarisha-8 but less duration was taken in later one.

**FSRD site, Ishan Gopalpur, Faridpur**

Plants/m$^2$, siliqua/plant, seeds/pod, 1000-seed wt. and seed yields were significantly influenced by different groups of mustard (Table 2). Among the duration shortest duration from variety Tori-7 which close to TS-72. Higher siliqua/plant was obtained from Daulat followed by BARI Sarisha 11. The lowest siliqua was recorded from Sonali. Significantly the highest seeds/pod was obtained from SS-75. Higher seed weight revealed from BARI Sarisha-12. The variety BARI Sarisha-7 showed significantly the highest grain yield among the variety/line which took 94 days. Among the short duration variety, TS-72 followed Tori-7 showed higher yield.

**FSRD site, Golapganj, Sylhet**

Plant height, days to maturity, yield attributes, and seed weights were significantly influenced by different varieties. The highest plant height was recorded from Rai-5 which was followed by BARI Sarisha –11 (Table 3) and the lowest plant height from Tori-7. The highest siliqua/plant was obtained from BARI Sarisha-11 followed by BARI Sarisha-10. Significantly the highest seeds/siliqua was recorded from BARI Sarisha-9. BARI Sarisha-11, revealed higher seed weight. Significantly the highest seed yield (1229 kg/ha) was obtained from BARI Sarisha which mature 96 days. Though Tori-7 much earlier (74 days) but yield was much less than other variety. Though BARI Sarisha-6 showed the highest yield in 2001-02 but this variety was not included in 2002-03. On an average BARI Sarisha-11, 10 & 9 were statistically similar yield.

**MLT Site, Magura**

Different variety showed significant influenced by plant height, yield attributes and yield (Table 4). The highest plant height was obtained from Rai-5 followed by Daulat and shortest from BARI Tori-7. The variety Jamalpur-1 showed the highest pods/plant followed by Daulat & Rai-5 and the lowest from S-75. The highest seeds/pod was recorded from BARI Sarisha-9 & SS-75. The variety BARI Sarisha-8 revealed significantly the highest yield (1.87 t/ha).

**MLT site, Norail, Jessore**

All the characters were significantly influenced by different group of varieties. The highest plant height was recorded from Daulat followed by Rai-5 and ISD local and shortest from BARI Sarisha-7. The highest seeds/siliqua was obtained from variety SS-75 & BARI Sarisha-8. Higher pods/plant was recorded from BARI Sarisha-6 followed by PT 303 & BARI Sarisha-7. Among the varieties higher seed yield was obtained from PT-303 followed by all variety & line except Rai-5 (Table 5).

**MLT site, Kushtia**

All the characters were significantly influenced by different variety except days to maturity (Table 6). Significant the highest plant height from Jamalpur-1 (BARI Sarisha-11) whereas shortest from Tori-7 followed by BARI Sarisha-9 and BARI Sarisha 12. Higher siliqua/plant was recorded from BARI Sarisha-9 closely followed by BARI Sarisha 6 & 11. But BARI Sarisha-6 showed significantly higher seed/siliqua. The highest seed yield was obtained from BARI Sarisha-6, which was statistically identical to BARI Sarisha-11 and BARI Sarisha-8.

**ARS, Bogra**

All the characters were significantly affected by different varieties (Table 7). The variety Rai-5 showed the highest plant height and the lowest from BARI Sarisha-7. Significantly the highest pods/plant was recorded from Daulat followed by Rai-5. But seeds/pod showed from SS-75 which was significantly different from other variety. Similarly the highest seed weight was recorded from SS-75. All the yield contributing character higher from SS-75 but failed to show higher yield due to lower no. of pod/plant. Higher seed yield was recorded from Ishurdi local followed by Jamalpur-1 & Daulat. On an average, the highest seed yield was obtained from Ishurdi local.

**MLT site, Joypurhat**

Duration, plant the highest, yield and yield attributes were significantly influenced by variety. The highest plant height from Rai-5 which was significantly differs from other variety. The variety Jamalpur local/Ishurdi local showed similar pods/plant & higher than all other variety. The variety SS-75 showed significantly the highest seed weight. Significantly the highest grain yield was obtained from Ishurdi local (Table 8).

**MLT site, Nandigram**

Duration, plant height, yield and yield attributes were significantly influenced by variety. The variety Rai-5 showed the highest plant the height weight and the lowest from BARI Sarisha-7 (Table 9). The variety Ishurdi local and Jamalpur local showed similar pods/plant. Seeds/pod revealed the highest from BARI Sarisha-7. Significantly the highest seed weight was obtained from BARI Sarisha-7. The highest seed yield was recorded from Ishurdi local followed by BARI Sarisha-8.

**MLT site, Narhatta**

Different varieties significantly influenced duration, plant height, yield & yield attributes of mustard. The highest plant the highest was recorded from Rai-5 followed by PT – 303 and shortest plant from Tori-7. The highest pod/plant was recorded from BARI Sarisha-10 followed by BARI Sarisha 9 & Rai-5. Significantly the highest seed/pod was obtained from BARI Sarisha-8. The variety BARI Sarisha 8 & 7 was statistically identical in respect of grain weight & higher than other variety. Similar trend was followed in case of grain yield.

**MLT site, Gabtali**

Duration plant height, yield & yield attributes were significantly differ among varieties. Shortest duration from Tori-7 and longest from Daulat & Jamalpur. The highest pods/plant was recorded from Ishurdi local followed by Jamalpur-1 but seed/pod was the highest from BARI Sarisha-8 followed by BARI Sarisha-6. Significantly the highest seed weight was obtained from SS-75. The variety BARI Sarisha-8 showed the highest grain yield which was closely followed by Rai-5.

## Conclusion

From the above result it showed that BARI Sarisha-11 and BARI sharisah-8 at Tangail, BARI Sarisha-7 at Faridpur, BARI Sarisha-11 at Sylhet, BARI Sarisha-8 at Magura, PT-303 at Norail, BARI Sarisha-6 or BARI Sarisha-11 or BARI Sarisha-8 at Kushtia and Ishurdi local at Bogra, Ishurdi local at Joypurhat, Nandigram, BARI sharia-8/7 at Narhatta and BARI Sarisha-8 and Rai-5 at Gabtali is found suitable for mustard but this need further trial for confirmation. The experiment needs to repeat at later four sites.

Table 1. Duration, plant/m$^2$, plant height, yield and yield contributing characters of some promising rape mustard varieties/lines (FSRD site, Palima, Tangail during rabi, 2002- 03)

| Variety /Line | Duration (days) | Plant pop$^n$/m$^2$ | Plant ht.(cm) | No. of branch/ plant. | No. of pod/pt. | No. of seeds/ pod | 1000- grain wt.(g) | Grain yield (t/ha) | | Biomass (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 01-02 | 02-03 | |
| ***Brassica campestris L*** | | | | | | | | | | |
| Tori-7 | 74h | 95.0c | 92.7g | 1.3e | 42.0ghi | 10.13ef | 2.6g | 1.42ab | 0.95d | 3.48fg |
| BARI Sarisha-6 | 84e | 93.7cd | 112.3de | 2.47f | 34.20hi | 21.27d | 3.28d | 1.07b | 0.95d | 3.83def |
| BARI Sarisha-9 | 76g | 93.7cd | 104.6f | 5.13b | 74.53de | 13.13d | 2.62f | 1.48ab | 1.08bc | 4.08cde |
| BARI Sarisha-12 | 76g | 92.7cd | 106.5ef | 4.47c | 78.2d | 12.3de | 2.52h | 1.42ab | 1.02cd | 3.85de |
| PT-303 | | | | | | | | 1.36abc | | |
| TS-72 | 76g | 92.3cd | 116.0cd | 6.13a | 56.13fg | 25.0a | 2.3i | 0.97ab | 1.13bc | 3.73ef |
| SS-75 | 82f | 100.7a | 122.2c | 1.8g | 28.47 i | 25.0a | 3.5b | 1.69a | 0.92d | 4.12cd |
| ***Brassica juncia L.*** | | | | | | | | | | |
| BARI Sarisha-10 | 84e | 94.0cd | 111.1def | 3.47e | 138.0d | 10.47def | 2.65e | 1.53ab | 1.16b | 5.12b |
| BARI Sarisha-11 | 104a | 96.0bc | 147.8a | 3.6d | 138.9b | 9.27f | 3.7a | 1.43ab | 1.29a | 5.58a |
| Rai-5 | 88b | 99.0ab | 145.8a | 4.6bc | 201.2a | 10.47def | 1.64k | 1.19bcd | 1.29a | 5.22b |
| Daulat | 85d | 101.7a | 133.6b | 2.67f | 123.5c | 12.80de | 2.00j | 1.69a | 1.31a | 5.65a |
| ***Brassica napus L.*** | | | | | | | | | | |
| BARI Sarisha -7 | 88b | 92.7cd | 88.53g | 4.07cd | 45.3gh | 17.13c | 3.4c | 1.05cd | 1.10bc | 3.32g |
| BARI Sarisha-8 | 85c | 90.0d | 94.13g | 3.67de | 62.87ef | 19.87b | 3.41c | 1.61a | 1.30a | 4.29c |
| CV% | 0.18 | 2.33 | 3.34 | 8.46 | 9.35 | 9.79 | 0.01 | 14.03 | 5.57 | 4.56 |

Means followed by same letter is not significantly different at 5% level by DMRT.

Table 2. Yield and yield attributes of rapeseed and mustard varieties tested at FSRD site, Ishan Gopalpur, Faridpur during Rabi 2002-03

| Variety | Duration | No. of plants /m2 | No. of siliqua/plant | No. of seed/pod | 1000 seed wt. (gm) | Seed yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 |
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 73 | 69.7a | 122.7abc | 14.3c | 2.93de | 1040e | 1026.7bc |
| BARI Sarisha-6 | 97 | 42.7cde | 83.0cd | 21.0b | 3.77b | 1730ab | 763.3e |
| BARI Sarisha -9 | 95 | 59.7ab | 124.0abc | 14.0c | 2.53ef | 1340d | 1093.3bcd |
| BARI Sarisha -12 | 95 | 42.7cde | 129.0ab | 15.0bc | 4.43a | - | 846.7cd |
| TS-72 | 79 | 58.7abc | 115.0a-d | 16.3bc | 3.07cd | 1420cd | 1140bc |
| SS-75 | 94 | 42.7cde | 88.0bcd | 26.3a | 3.57bc | 1870a | 786.7e |
| ***Brassica juncia*** | | | | | | | |
| BARI Sarisha -10 | 96 | 47.7b-e | 138.0a | 13.3c | 3.60b | 740f | 1203.3b |
| BARI Sarisha -11 | 98 | 41.7de | 145.0a | 12.0c | 3.00d | - | 1036.7be |
| Rai-5 | 97 | 38.3e | 108.0a-d | 13.3c | 3.57bc | 950ef | 796.7de |
| Sonali | 100 | 44.0b-e | 74.0d | 20.7b | 2.09f | - | 746.7e |
| Daulat | 102 | 42.0de | 160.0a | 13.0c | 2.47ef | 1100e | 1143.3bc |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha –7 | 93 | 56.3a-d | 90.0bcd | 20.3b | 3.37bcd | 1890a | 1556.7a |
| BARI Sarisha –8 | 94 | 64.3a | 111.7a-d | 17.0bc | 3.37bcd | 1820a | 1116.7bc |
| CV (%) | - | 6.6 | 19.0 | 18.8 | 8.6 | 9.5 | 15.7 |

Table 3. Yield and yield contributing characters of mustard and rapeseed varieties at FSRD site, Golapganj, Sylhet, 2002-2003

| Variety | Plant height (cm) | Days to maturity | Siliqua/ plant (no.) | Seeds/ siliqua (no.) | 1000 seed wt. (g) | Seed yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2000-01 | 2002-03 |
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 74.65 | 74 | 48 | 14.10 | 2.50 | 821 | 785 |
| TS-72 | - | - | - | - | - | 960 | - |
| SS-75 | - | - | - | - | - | 1180 | - |
| PT 303 | - | - | - | - | - | 980 | - |
| BARI Sarisha-6 | - | - | - | - | - | 1725 | - |
| BARI Sarisha-9 | 79.40 | 82 | 85 | 15.10 | 2.71 | 1195 | 1035 |
| ***Brassica juncia* L.** | | | | | | 960 | 805 |
| Rai-5 | 118.6 | 94 | 77 | 11.20 | 1.92 | 1020 | - |
| Daulat | - | - | - | - | - | 1055 | - |
| BARI Sarisha-10 | 98.5 | 90 | 112 | 10.20 | 2.61 | 1125 | 1105 |
| BARI Sarisha-11 | 109.2 | 96 | 103 | 12.10 | 3.10 | 1079 | 1224 |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha-7 | - | - | - | - | - | 1656 | - |
| BARI Sarisha-8 | - | - | - | - | - | 1502 | - |
| LSD (.05) | 4.88 | 3.49 | 15.44 | 2.88 | - | 143.7 | 55.0 |

Table 4. Performance of mustard varieties at the MLT site, Magura during 2002-03

| Treatments | Plant height (cm) | Branch/ plant | Pods/ plant | Seed/pod | 1000 grain wt. (g) | Grain yield (t/ha) | | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 | |
| ***Brassica campestris* L.** | | | | | | | | |
| Tori-7 | 97.40f | 4.07ab | 108.00de | 15.67de | 2.90ef | 0.83ab | 1.01e | 2.06f |
| TS 72 | 100.30f | 4.33a | 117.30de | 15.67de | 2.79h | 0.92ab | 1.49bc | 2.70def |
| SS 75 | 122.10d | 3.66ab | 68.33e | 22.67a | 4.00a | 1.047a | 1.73bc | 2.70d-f |
| PT-303 | 104.30ef | 3.80ab | 120.30de | 16.40cd | 2.80gh | 0.87ab | 1.40cd | 2.49ef |
| BARI Sarisha-6 | 111.70e | 3.87ab | 116.30de | 19.67b | 3.90b | 0.74ab | 1.51bc | 3.00cde |
| BARI Sarisha -9 | 100.30f | 3.67ab | 127.30de | 16.33cd | 2.67e | 1.04a | 1.51bc | 2.43ef |
| ***Brassica juncia* L.** | | | | | | | | |
| BARI Sarisha-10 | - | - | - | - | - | 0.91ab | - | - |
| Rai-5 | 158.90a | 3.07ab | 246.30a | 12.73ef | 2.17j | 0.68b | 1.43cd | 4.04ab |
| Daulat | 157.30ab | 3.23ab | 251.30a | 11.67f | 2.27i | 0.85ab | 1.39cd | 4.49a |
| ISD local | 146.60c | 3.50ab | 239.70ab | 12.00f | 2.87fg | 0.86ab | 1.40cd | 3.97ab |
| Jamalpur local | 150.40bc | 3.13ab | 253.30a | 11.33f | 2.77h | 0.69b | 1.38cd | 4.52a |
| ***Brassica napus* L.** | | | | | | | | |
| BARI Sarisha -7 | 101.10f | 4.00ab | 188.00bc | 19.00bc | 3.37c | 1.05a | 1.61bc | 3.39bcd |
| BARI Sarisha -8 | 108.20ef | 3.67ab | 139.00cd | 22.67a | 3.97ab | 0.87ab | 1.87a | 3.82abc |
| CV (%) | 3.89 | 24.48 | 19.28 | 10.21 | 1.81 | | 9.45 | 15.23 |

Table 5. Performance of mustard varieties at the MLT site, Norail during 2002-03

| Treatments | Plant height (cm) | Branch/ plant | Pods/ plant | Seed/pod | 1000 grain wt. (g) | Grain yield (t/ha) | | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 | |
| ***Brassica campestris* L.** | | | | | | | | |
| Tori-7 | 72.20de | 2.67cde | 72.93a | 15.57c | 2.70ef | 1.03ab | 0.72ab | 1.98cd |
| TS 72 | 76.90d | 2.83cde | 63.43ab | 16.40c | 2.80ef | 1.35a | 0.85a | 1.83cd |
| SS 75 | 89.40c | 3.93b | 53.27b | 22.60a | 3.27bcd | 1.24ab | 0.61b | 1.78d |
| PT-303 | 79.57d | 3.23c | 76.33a | 16.00c | 3.00de | 1.31a | 0.73ab | 2.21cd |
| BARI Sarisha-6 | 101.40b | 4.67a | 77.37a | 18.30b | 3.37abcd | 1.08ab | 0.71ab | 3.32abc |
| BARI Sarisha-9 | 74.90de | 2.77cde | 71.43ab | 15.27c | 2.77ef | 1.18ab | 0.70ab | 2.87bcd |
| ***Brassica juncia* L.** | | | | | | | | |
| Daulat | 117.80a | 2.33ef | 66.27bb | 13.20de | 2.63ef | 1.11ab | 0.62b | 3.97ab |
| ISD local | 110.30a | 2.30ef | 63.07ab | 11.27f | 3.47abc | 1.16ab | 0.59b | 4.47a |
| Jamalpur | 114.20a | 1.97f | 62.30ab | 11.53ef | 3.60ab | 1.12ab | 0.58b | 4.76a |
| Rai-5 | 116.20a | 2.53def | 71.30ab | 13.43d | 2.50f | 0.94b | 0.79ab | 3.35abc |
| ***Brassica napus* L.** | | | | | | | | |
| BARI Sarisha-7 | 68.30e | 2.97cd | 74.13a | 19.60b | 3.20cd | 1.27ab | 0.63b | 4.00ab |
| BARI Sarisha-8 | 74.87de | 2.67cde | 61.47ab | 21.60a | 3.70a | 1.38a | 0.96ab | 2.25bcd |
| CV (%) | 5.03 | 11.26 | 14.00 | 6.37 | 6.87 | 15.15 | | 25.54 |

Table 6. Yield and yield attributes of different varieties /lines of mustard in Kushtia during 2002-03

| Name of variety | Field duration (days) | Plant pop. /m$^2$ | Plant height (cm) | Siliqua/ plant (no.) | Seed/ Siliqua (no.) | 1000-seed wt. (gm) | Seed yield (kg/ha) | | Stover yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2001-02 | 2002-03 | |
| ***Brassica campestris* L.** | | | | | | | | | |
| Tori-7 | 85 | 32.0ab | 96.08c | 114.43a | 10.77d | 2.70a | 1102.7de | 1307.7b | 2748.0ef |
| BARI Sarisha-6 | 100 | 31.53ab | 111.3b | 117.72a | 27.90a | 2.83a | 1437.7bc | 1519.3a | 3458.3cd |
| BARI Sarisha-9 | 87 | 33.33a | 97.89c | 120.31a | 13.07dc | 2.53ab | 1229.3def | 1397.7b | 2957.7ef |
| BARI Sarisha-12 | 87 | 34.10a | 100.35b | 96.83b | 11.50cd | 2.31b | - | 1311.0b | 2660.0f |
| TS-72 | | | | | | | 1213.3de | | |
| PT-303 | | | | | | | 1177.7de | | |
| SS-75 | | | | | | | 1591.0ab | | |
| ***Brassica juncia* L.** | | | | | | | | | |
| BARI Sarisha-10 | 102 | 32.00ab | 118.90ab | 97.31b | 10.93d | 2.57ab | 1210.3de | 1386.7b | 3310.0d |
| ISD Local | | | | | | | 1168.7de | | |
| Jamalpur-1 | | | | | | | 1265.7cd | | |
| BARI Sarisha-11 | 106 | 30.60b | 130.17a | 117.48a | 12.27a | 2.63ab | | 1509.3a | 4729.3a |
| Rai-5 | | | | | | | 1020.7e | | |
| Daulat | | | | | | | 1241.3cde | | |
| ***Brassica napus* L.** | | | | | | | | | |
| BARI Sarisha-7 | | | | | | | 1629.3ab | | |
| BARI Sarisha-8 | 98 | 33.57a | 100.35b | 105.95ab | 16.13b | 2.56ab | **1652.3a** | 1504.3a | 3576.7c |
| Jata Rai | 108 | 30.60b | 117.91 | 114.20a | 10.6d | 2.58ab | 1035.6e | 1385.7b | 4280.7b |
| CV (%) | | 4.2 | 4.5 | 7.1 | 7.6 | 7.5 | | 3.7 | 3.6 |
| F-test | | * | * | * | ** | - | | ** | ** |

Table 7. Performance of different characters of mustard varieties at level Barind soil of ARS, OFRD, BARI, Bogra during Rabi 2002-03

| Varieties | Duration of crop (days) | Plant height (cm) | Pods/plant (no.) | Seeds/ pod (no.) | 1000-grain wt. (gm) | Grain yield (t/ha) | | Stover yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2001-02 | 2002-03 | |
| ***Brassica campestris* L.** | | | | | | | | |
| Tori-7 | 88.67 d | 89.2ef | 55.83f | 16.93c | 3.52cd | 1.073f | 0.76d | 3.6e |
| TS-72 | 88.33d | 92.2e | 43.43g | 16.97c | 3.32d | 1.157f | 0.50e | 2.7h |
| SS-75 | 79.0f | 113.5d | 34.03h | 28.87a | 4.91a | 1.350ef | 0.58e | 3.29f |
| PT-303 | 88.33d | 86.13f | 48.77fg | 16.80c | 3.65c | 1.317f | 0.58e | 2.98g |
| BARI Sarisha-6 | 85.33e | 127.9c | 94.80e | 21.30b | 3.91b | 1.930cd | 0.97c | 4.72c |
| BARI Sarisha-9 | 87.67d | 94.57e | 47.93fg | 16.90c | 2.87ef | 1.223f | 1.01c | 4.02d |
| ***Brassica juncia* L.** | | | | | | | | |
| Jamalpur-1 | 104.0b | 130.9bc | 92.83e | 14.50d | 4.02b | 2.35a | 1.55ab | 3.50ef |
| BARI Sarisha-10 | 103.3b | 129.0c | 115.2bc | 15.03cd | 2.89ef | 1.733cd | 1.42b | 4.01d |
| Ishurdi local | 109.0a | 128.0c | 107.4cd | 14.04d | 3.60c | 2.30ab | 1.58a | 4.09d |
| Rai-5 | 104.3b | 138.5a | 123.0ab | 14.37d | 3.00e | 1.017f | 1.41b | 3.46ef |
| Daulat | 105.0b | 136.1ab | 129.5a | 16.13cd | 2.72f | 1.160f | 1.52ab | 4.85ba |
| ***Brassica napus* L.** | | | | | | | | |
| BARI Sarisha-7 | 109.7a | 76.80g | 99.57de | 15.20cd | 3.65c | 2.017bc | 0.76d | 5.13a |
| BARI Sarisha-8 | 95.67c | 83.70f | 116.2bc | 19.20b | 3.99b | 1.637de | 0.81d | 5.07ab |
| F-Test | 1.11 | 3.2 | 6.26 | 7.53 | 3.97 | *** | - | 3.97 |
| CV (%) | * | * | * | * | * | 11.44 | 8.77 | * |

Figure(s) followed by different letters in the same column are statistically significant at 0.1% level of probability

Table 8. Mean performance of different characters of 13 Mustard varieties at MLT site Joypurhat, Bogra during 2002-03

| Varieties | Duration (days) | Plant height (cm) | Pod/plant (no) | Seed/pod (no) | 1000-seed weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 74.17f | 87.12l | 83.30de | 14.42e | 2.70h | 0.72g | 1.74e |
| TS-72 | 82.50e | 86.12l | 91.77cd | 16.00d | 3.67b | 1.04d | 2.15d |
| SS-75 | 96.33d | 97.23ef | 85.08de | 29.30a | 3.55c | 1.49b | 3.05b |
| PT-303 | 71.17g | 92.42gh | 95.78c | 14.62de | 3.24e | 0.73fg | 1.65e |
| BARI Sarisha-6 | 96.83d | 105.30cd | 87.53cd | 19.55c | 2.83g | 1.16c | 2.22d |
| BARI Sarisha-9 | 74.50f | 95.42fg | 85.77c-e | 14.78de | 3.73b | 0.81ef | 1.75e |
| ***Brassica juncia* L.** | | | | | | | |
| Jamalpur-1 | 103.20ab | 114.40b | 234.30a | 9.98g | 3.44d | 1.47b | 2.90b |
| BARI Sarisha-10 | 100.30bc | 108.80c | 162.20b | 10.78fg | 2.62ij | 1.16c | 2.35cd |
| Ishurdi local | 104.70a | 116.00b | 232.80a | 9.38g | 2.96f | 1.58a | 3.30a |
| Daulat | 103.00ab | 105.10cd | 98.53cd | 11.50f | 2.15k | 0.84e | 1.79e |
| Rai-5 | 101.70bc | 125.40a | 84.72de | 9.52g | 2.57j | 0.67g | 1.57ef |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha-7 | 101.30bc | 89.43hi | 68.65f | 22.52b | 2.68hi | 0.67g | 1.39f |
| BARI Sarisha-8 | 99.00cd | 101.90de | 75.53ef | 22.62b | 3.80a | 1.19c | 2.57c |
| CV (%) | 2.73 | 4.04 | 8.12 | 8.28 | 1.70 | 6.47 | 9.10 |
| F-Test | * | * | * | * | * | * | * |

Figure (s) followed by different letters in same column are statistically significant at 5% level of probability.

Table 9. Mean performance of different characters of 13 Mustard varieties at Nandigram MLTs under Bogra during 2002-03

| Varieties | Duration (days) | Plant height (cm) | Pod/plant (no) | Seed/pod (no) | 1000-seed weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 76.83f | 90.22fg | 53.00fg | 12.77cd | 2.68d-f | 0.892g-I | 2.28gh |
| TS-72 | 77.50f | 93.97e | 55.72ef | 12.45de | 2.79c-e | 0.867hi | 2.01h |
| SS-75 | 94.17d | 100.30d | 32.20a | 19.22b | 3.64a | 0.705j | 2.33gh |
| PT-303 | 84.17e | 92.83ef | 55.43ef | 10.15g | 2.37gh | 0.838I | 2.15gh |
| BARI Sarisha-6 | 98.73a-c | 97.85d | 45.45h | 13.08c | 2.98bc | 0.992e-g | 3.32de |
| BARI Sarisha-9 | 77.50f | 105.30c | 58.40de | 12.10e | 2.73d-f | 0.862I | 2.62fg |
| ***Brassica juncia* L.** | | | | | | | |
| Jamalpur-1 | 101.70a | 113.30b | 81.45a | 10.18g | 2.75c-f | 1.197a-c | 3.85b-d |
| BARI Sarisha-10 | 98.17a-c | 105.20c | 74.43b | 12.45de | 2.56fg | 1.063d-f | 3.20e |
| Ishurdi local | 100.80ab | 114.50b | 79.58a | 11.10f | 2.88b-d | 1.250a | 4.48a |
| Daulat | 96.50cd | 104.70c | 57.78de | 9.97g | 2.26h | 0.975f-h | 3.12ef |
| Rai-5 | 97.17b-d | 118.80a | 49.97g | 12.23e | 2.61ef | 1.095c-e | 3.62c-e |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha-7 | 101.30a | 87.22g | 59.63ed | 21.62a | 3.53a | 1.107b-d | 4.15a-c |
| BARI Sarisha-8 | 101.80a | 93.12ef | 61.95c | 19.03b | 3.04b | 1.215ab | 4.23ab |
| CV (%) | 3.66 | 3.07 | 4.72 | 2.88 | 6.94 | 9.49 | 15.43 |
| F-Test | * | * | * | * | * | * | * |

Figure (s) followed by different letters in same column are statistically significant at 5% level of probability.

Table 10. Mean performance of different characters of 13 Mustard varieties at Narhatta MLTs under Bogra during 2002-03

| Varieties | Duration (days) | Plant height (cm) | Pod/plant (no) | Seed/pod (no) | 1000-seed weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 84.00d | 86.37h | 80.43fg | 11.01f-h | 3.14c-e | 0.84h | 2.17e |
| TS-72 | 84.83d | 96.90fg | 111.20d-e | 12.40e | 3.39bc | 1.00fg | 2.41c-e |
| SS-75 | 99.67bc | 114.20b | 71.73g | 12.99de | 3.30b-d | 1.13d-e | 2.63a-c |
| PT-303 | 84.83d | 98.25a | 117.00c-e | 11.89e-g | 3.39bc | 0.95gh | 2.38de |
| BARI Sarisha-6 | 99.33c | 103.10d-f | 39.43h | 17.42b | 3.05de | 1.21cd | 2.96ab |
| BARI Sarisha-9 | 84.33d | 105.30c-e | 134.90ab | 13.75ed | 2.91e | 1.09ef | 2.45b-d |
| ***Brassica juncia* L.** | | | | | | | |
| Jamalpur-1 | 102.20a-c | 115.10b | 123.10b-d | 12.14ef | 2.91e | 1.39b | 2.67ab |
| BARI Sarisha-10 | 102.80a | 115.20b | 143.40a | 10.68h | 2.45f | 1.13de | 2.38de |
| Ishurdi local | 102.20a-c | 112.10bc | 126.90bc | 10.40h | 3.42b | 1.37b | 2.72a |
| Daulat | 102.00a-c | 108.20b-d | 107.20e | 10.96gh | 2.61f | 1.32bc | 2.58a-d |
| Rai-5 | 103.00ab | 124.70a | 132.10ab | 11.98e-g | 3.34bc | 1.36b | 2.55a-d |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha-7 | 104.30a | 89.28gh | 87.38f | 14.50bc | 4.26a | 1.69a | 2.65a-c |
| BARI Sarisha-8 | 104.20a | 99.87ef | 69.73g | 21.32a | 4.34a | 1.70a | 2.61a-d |
| CV (%) | 3.04 | 6.52 | 10.37 | 7.62 | 7.06 | 8.76 | 8.25 |
| F-Test | * | * | * | * | * | * | * |

Figure (s) followed by different letters in same column are statistically significant at 5% level of probability.

Table 11. Mean performance of different characters of 13 Mustard varieties at Gabtali MLTs under Bogra during 2002-03

| Varieties | Duration (days) | Plant height (cm) | Pod/ plant (no) | Seed/pod (no) | 1000-seed weight (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| ***Brassica campestris* L.** | | | | | | | |
| Tori-7 | 76.83d | 79.63f | 59.98de | 11.55ef | 3.01e-h | 0.85g | 2.56f |
| TS-72 | 78.50cd | 86.00ef | 46.97f | 11.10fg | 2.80fg | 0.85g | 2.22f |
| SS-75 | 101.70a | 101.30bc | 18.40g | 16.42bc | 4.50a | 0.54h | 4.52d |
| PT-303 | 79.670c | 90.28de | 42.52f | 10.65f-h | 3.16de | 0.97f | 3.16e |
| BARI Sarisha-6 | 100.30a | 95.43cd | 38.80f | 14.90cd | 3.64b | 0.03ef | 4.53cd |
| BARI Sarisha-9 | 83.83b | 102.10bc | 56.78e | 12.13ef | 3.09d-f | 0.83g | 2.33f |
| ***Brassica juncia* L.** | | | | | | | |
| Jamalpur-1 | 102.30a | 119.20a | 82.25ab | 8.27c | 3.50bc | 1.23d | 4.52d |
| BARI Sarisha-10 | 100.50a | 107.90b | 71.27c | 13.13de | 2.73g | 1.27cd | 4.67b-d |
| Ishurdi local | 100.80a | 119.60a | 84.53a | 9.22hi | 3.31cd | 1.34bc | 4.96ab |
| Daulat | 102.50a | 119.60a | 69.55c | 10.72f-h | 2.14h | 1.10e | 4.43d |
| Rai-5 | 101.20a | 126.20a | 72.92bc | 9.67g-h | 2.23h | 1.40ab | 4.90a-c |
| ***Brassica napus* L.** | | | | | | | |
| BARI Sarisha-7 | 100.80a | 89.18de | 59.25de | 17.20ab | 3.65bc | 1.29cd | 4.78a-d |
| BARI Sarisha-8 | 101.80a | 95.71cd | 67.08cd | 18.77a | 3.63b | 1.45a | 5.08a |
| CV (%) | 1.99 | 6.71 | 13.67 | 12.52 | 8.34 | 7.51 | 7.89 |
| F-Test | * | * | * | * | * | * | * |

Figure (s) followed by different letters in same column are statistically significant at 5% level of probability.

Table 12. Yield and yield contributing characters of different rape seed mustard at Narikeli, Jamalpur, 2002-03

| Treat | Flowering (days) | Maturity (days) | Primary branches /plant (no.) | Branches/ plant (no.) | Silequa/ plant (no.) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|
| ***Brassica campestris* L.** | | | | | | |
| Tori- 7 | 28 | 75 | 3.3 | 6.8 | 85 | 812 |
| TS-72 | 35 | 82 | 3.5 | 5.8 | 92 | 890 |
| SS-75 | 45 | 93 | 3.3 | 5.4 | 103 | 1380 |
| BARI Sarisha -6 | 42 | 95 | 2.8 | 4.8 | 72 | 1350 |
| BARI Sarisha-9 | 37 | 85 | 3.5 | 6.8 | 110 | 1210 |
| BARI Sarisha-12 | 46 | 95 | 3.5. | 5.9 | 93 | 1335 |
| ***Brassica juncia* L.** | | | | | | |
| Rai- 5 | 41 | 94 | 3.6 | 8.6 | 129 | 1205 |
| BARI Sarisha-10 | 46 | 95 | 3.0 | 6.3 | 105 | 1277 |
| BARI Sarisha-11 | 43 | 96 | 3.6 | 6.2 | 98 | 1425 |
| Daulat | 43 | 96 | 3.4 | 6.3 | 125 | 1220 |
| ***Brassica napus* L.** | | | | | | |
| BARI Sarisha-7 | 42 | 89 | 2.7 | 6.9 | 112 | 1356 |
| BARI Sarisha-8 | 35 | 86 | 3.2 | 5.8 | 65 | 1465 |

# FARMERS FIELD TRIAL OF CHICKPEA


## Abstract

A farmers' yield trial of chickpea with five lines and one variety was conducted at FSRD site, Ishan Gopalpur, Faridpur during rabi 2002-03 to observe the performance of different varieties/lines of chickpea. Grain yield and yield attributes were significantly different among the varieties/lines except 100-seed weight. Significantly the highest grain yield was produced by BCX-91040-3 (1063.7 kg/ha) followed by BARI Chola-5 (950 kg/ha) and the lowest by BCX-91044-3 (683.3 kg/ha).


## Introduction

Chickpea is the 3rd number of pulse crop of Bangladesh in respect to area (99543 ha) with production of only 50771.5 tons. Few numbers of recommended varieties of chickpea are available. So, it is need to release more number of high yielding chickpea varieties. Keeping this in mind the trial was undertaken to evaluate the performance of these new lines/varieties in the farmers' field.

## Materials and Methods

The experiment was conducted at the FSRD site, Ishan Gopalpur, Faridpur during rabi 2002-03 following RCB design with 4 replications under rainfed condition in farmers' field. The unit plot size was 6 m x 5 m and seeds were sown in line with 40 cm spacing on 29th November 2002. The crop was fertilized 20-40-20 kg-N-PO-KO/ha at final land preparation. No irrigation and weeding were done. Fungicide (Bavistin) was sprayed once on 25th February 2003 to control the Botrytis Grey Mold (BGM) disease. Insecticide was also applied to control pod borer. The crop was harvested on the 24th to 29th March 2003.

## Result and Discussion

Plant height, plant/m$^2$, pods/plant and seed yield was significantly influenced by variety/lines. The line BCX-910403 matured earlier (i.e. 5 days) than other variety/lines. The line BCX-91043-1 showed higher plant height but statistically identical to BCX-91040-3 and special plant-3. Pods/plant produced similar in number except BCX-910443 which showed the lowest no. of pods/plant. Seed weight was not influenced with the variety/line. The highest seed yield was recorded from BCX-91040-3 line which statistically identical to variety BARI Chola-5. The average yield of chickpea in this years was no good due to high rainfall during the pod formation stage, which encourages the attack of pod borer.

Table 1. Yield and yield attributes of chickpea varieties/lines tested at FSRD site, Ishan Gopalpur, Faridpur during rabi 2002-03

| Variety/line | Duration (days) | Plant height (cm) | No. of plants/m$^2$ | No. of pod/plant | 100-seed wt. (gm) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|
| Special plant-7 | 119 | 37.9a | 37.9a | 45.0ab | 10.97 | 871b |
| Special plant-3 | 119 | 35.9ab | 35.9ab | 47.0ab | 10.63 | 837b |
| BCX-91044-3 | 119 | 32.8b | 32.8b | 39.7b | 11.13 | 683c |
| BCX-91043-1 | 119 | 32.1b | 32.1b | 51.7a | 11.17 | 813bc |
| BCX-91040-3 | 114 | 35.4ab | 35.4ab | 49.0ab | 10.74 | 1064a |
| BARI Chola-5 | 119 | 39.3a | 23.7a | 41.3ab | 11.00 | 950ab |
| CV (%) | | 6.5 | 11.6 | 12.5 | 4.2 | 8.9 |
| LSD (0.05) | | ** | ** | * | NS | ** |

# ON-FARM TRIAL TO EVALUATE THE EFFECT OF SEED SOURCE ON BGM INCIDENCE IN BARI CHOLA-5

## Introduction

Chickpea grown in the High Barind Tract (HBT) of Bangladesh is largely not infected by BGM (Botrytis grey mould) and thus seed derived from the HBT should be disease free. It is thus hypothesized that BGM incidence will be less in HBT derived seed than in locally (Faridpur region) produced seed. It is therefore necessary to test this hypothesis in farmers' fields using chickpea variety BARI Chola-5. In the presence of absence of foliar application of fungicide (e.g. Bavistin or Acrobat).

## Objectives:

To determine the extent of BGM development in chickpea crops grown either BGM infested area (e.g. Jessore region) or a BGM free area (High Barind Tract) under conditions of with and without application of fungicide.

## Materials and Methods

The trial was conducted on farmers' field at FSRD site, Ishan Gopalpur, Faridpur during rabi season of 2002-03. The land type was medium having clay loam soil. The experiment was laid out in RCB design with five dispersed replications. The unit plot size was 0.2 bigha (266. sq. meter). Four treatments were used in the trial, i) Local seed with no spray, ii) HBT seed with no spray, iii) Local seed with spray and iv) HBT seed with spray. Seed at the rate of 45 kg/ha were sown by broadcasting from 3rd December to 14th December 2002. Fertilizer at the rate of 20 kg P/ha was applied at final land preparation. Fungicide Bavistin was sprayed after 50% completion of flowering at the rate of 66 gm in 66-liter water for one bigha area. Insecticides Dessis was sprayed at the rate of 33 ml in 33-liter water for one bigha area. Heavy rainfall (March 110.36 mm) during the pod formation stage of chickpea encourages the pod borer. The crop was harvested from 5th April to 10th April 2003.

## Results and Discussion

Local seed with spray and no spray showed early flowering than HBT seed with spray and no spray. Significant difference was not found among the plants/m2 at 30 DAS and at maturity. But seed yield significantly affected by the treatments. Higher seed yield was obtained from local seed with spray but statistically identical to HBT seed with spray. The lowest seed yield recorded from local seed with no spray but at par to HBT seed with no spray. It is noted that spray either local seed or HBT seed showed significantly higher yield than no spray either seed collected from locally or HBT.

Table 1. Yield performance of chickpea as affected by seed source in BGM infested area in BARI Chola-5 at FSRD site, Ishan Gopalpur, Faridpur during rabi 2002-03

| Treatment | Days to flowering | No. of plants/$m^2$ (30 DAS) | No. of plants/$m^2$ (at maturity) | Seed yield (kg/ha) |
|---|---|---|---|---|
| HBT seed with spray | 70 | 24.8 | 22.2 | 1006a |
| Local seed with spray | 67 | 26.6 | 23.2 | 1030a |
| HBT seed with no spray | 69 | 26.0 | 21.2 | 850b |
| Local seed with no spray | 67 | 24.2 | 21.0 | 842b |
| CV (%) | - | - | - | 3.1 |
| LSD (0.05) | NS | NS | NS | ** |

# BREAD WHEAT ADAPTIVE LINE TRIALS AT FARMER'S FIELD CONDITION


## Abstract

The experiment was conducted in medium high land at FSRD site, Tangail, Comilla, Pabna, Mymensingh, Dinajpur, Rangpur, Jessore and Jamalpur during rabi 2002-03 to assess the yield performance of bread wheat lines in different agro-climatic zones under farmer's field condition. It was observed that the higher grain yield recorded from BAW1008 in all most sites. But at Goyeshpur and Sujanagar where all lines/variety were showed statistical identical. At Magura, Chowgacha and Melandah, BAW966 produced superior grain yield than BAW1008.


## Introduction

Wheat (*Triticum aestivum*) is the second most important cereal crop next to rice, cultivated during rabi season in Bangladesh. The area and production of wheat were markedly increased from 1975-1985 and after that area and production started declining. This declining was probably associated with yield, higher production cost, decreasing soil fertility, low market price during the harvest price. Wheat Research Center of BARI has developed a good number of wheat lines/varieties and also some technologies to eliminate those constrain. The Wheat Research Center (WRC) conducted several on station trials with newly released bread wheat lines which need to be tested and compared with widely cultivated standard varieties at on farm level. The experiment was undertaken to assess the yield performance of bread wheat lines/variety and determines their potentiality.

## Materials and Methods

The experiment was undertaken at the farmers' field of Tangail, Comilla, Pabna, Mymensingh, Dinajpur, Rangpur, Jessore and Jamalpur during rabi 2002-03. Four advanced bread wheat lines were BAW966, BAW1006 and BAW1008 compared with released variety Kanchan in medium high land under irrigated condition. The experiment was laid out in a randomized block design with three replications. The unit plot size was 4m x 5m. The land was fertilized with 220 kg urea, 132 kg TSP, 68 kg MP, and 117 kg gypsum/ha. Two-third of urea and all amount of fertilizer were applied at final land preparation. Seeds were sown on 10 Dec., 20-25 Nov., 30 Nov.- 2 Dec., 25 Nov., 21-23 Nov., 25-30 Nov. at Tangail, Comilla, Pabna, Rangpur, Dinajpur, Jessore and Jamalpur, respectively. The crop was sown with 120 kg seed/ha at a spacing 20 cm in solid line. One irrigation was applied at 23 days after sowing (DAS) followed by rest urea as top dress. One hand weeding was done at 27 days after sowing. The crop was harvested on 16-20 March at Tangail, 29 March at Comilla, 22-26 March, Pabna, 28-31 March, Rangpur, 8-17 March, Dinajpur, 15-17 March at Jessore and 15-24 March, Jamalpur 2003, respectively. All necessary data were collected and analyzed statistically.

## Result and Discussion

### Site: Palima, Tangail

Days to maturity, yield and yield attributes were significantly influenced by different variety/line except plant height and length of spike. Grains/spike was significantly influenced by different variety/line. Number of grain/spike was obtained from Kanchan though significant difference was not found among variety/line except BAW1006. Bold grain size showed in line BAW1008 which was significantly different from other lines/variety. Higher grain yield was obtained from lineBAW1008, which was at par to line BAW966. The line BAW1008 showed 21% higher grain yield than Kanchan. The higher grain yield was achieved due to higher number of spikes/m$^2$ and grain weight. Straw yield showed higher from BAW1008 followed by all other variety/line except Kanchan.

### Site: Chandina, Comilla

Grain yields and 1000-grain weights were significantly influenced by different variety/lines (Table 2). The line BAW1006 showed significantly the highest grain weight among the varieties. Grain yield was not significantly influenced by variety and all the line showed higher grain yield than Kanchan.

Among the lines, BAW966 revealed slightly higher yield with shortest maturity days (103) as compared to other variety.

**Site: Sujanagar & Goyeshpur MLT site, Pabna**

At Sujanagar, grains/spike and 1000-grain weighty were significantly influenced by variety/line. Significantly the highest grains/spike was obtained from BAW966. The line BAW-1008 showed the highest grain weight among the lines/variety. Grain yield was not significantly influenced by variety/lines (Table 3a).

At Goyeshpur, grains/spike and 1000-grain weight were significantly affected by variety/line. The line BAW-1006 and BAW-1008 showed similar grains/spike. Significantly the highest grain weight was recorded from BAW-1008. Higher grain yield was obtained from BAW1006 which was statistically identical to other variety/lines (Table 3b).

**Site: Nilphamari and Polashbari, Rangpur**

The result revealed that there was significant difference in respect of all the characters studied except spikes/m$^2$, grain/spike and straw yield (Table 4a). Significantly higher 1000-grain weight was recorded from BAW1008. There was significant difference in respect of grain yield among the advance lines and released varieties, numerically the highest yield (5.01 t/ha) was obtained from BAW1008. The yield of all the tested lines were found to be reasonably good (4.66-4.98 t/ha).

At Polashbari, filled grain/spike, 1000-grain wt. and grain yields were significantly influenced by variety/line. The line BAW1008 showed higher no. of grains/spike but statistically at par to BAW966. Significantly the highest grain wt. was recorded from BAW1008. Similar trend was followed in case of grain yield. The line BAW1008 showed 21% higher grain yield than Kanchan. Straw yields were not statistically influenced by variety/line.

**Site: Mymensingh Sadar**

All yield attributes were significantly influenced by variety/line. Grains/spike showed similar in BAW1008 and BAW966. Significantly the highest grain wt. was recorded from BAW1006. The highest grain yield was obtained from BAW1008 which was significantly different from other variety/line. Straw yield also showed higher from BAW1008.

**Site: Shubra and Boda MLT, Dinajpur**

At Shubra, Grains/spike, 1000-grain wt. grain and straw yields were significantly influenced by variety/lines. Significantly the highest grains/spike was obtained from BAW-1008. Similar trend was followed in case of 1000-grain wt. Though the highest grain yield was recorded from BAW1008 but statistically at par to BAW1006. Straw yields were statistically similar except Kanchan which produced the lowest yield.

At Boda, yield attributes were significantly influenced by variety/line except straw yield. Significantly the highest grains/spike and 1000-grain wt. were recorded fromBAW1008 which resulted the highest grain yield among the variety/line.

**Magura MLT site**

Plant height and yield attributes were significantly influenced by variety/lines. Significantly the highest plant height was recorded from BAW1008. The line BAW966 and BAW1006 showed similar spike/m$^2$ and the lowest from BAW1008. The variety Kanchan and line BAW966, BAW1008 produced similar grain/spike whereas BAW1006 gave the lowest grain/spike. Significantly the highest grain weight was recorded from BAW1008. Higher grain yield was obtained from BAW966 which was statistically identical to BAW1008 but late line showed higher straw yield.

**Chowgacha MLT site, Jessore**

Plant height, Straw yield and yield attributes were significantly affected by variety/line. The highest plant height was recorded from BAW966 which was significantly different from other variety/lines. The lowest spikes/m$^2$ was obtained from BAW966 whereas other variety/lines were at par. Grains/spikes showed similar in variety Kanchan, BAW966 and BAW1008. Significantly the highest grain weight was recorded from BAW1008. BAW966 and BAW1008 showed similar yield and higher than Kanchan and BAW1006. BAW966 and BAW1008 showed similar yield and higher than Kanchan and BAW1006 but significantly the highest straw yield was obtained from BAW1008.

**Melandah MLT site, Jamalpur**

Plant height, straw yield, grain yield and yield attributes were significantly influenced by variety/line (Table 8a). Significantly the highest spikes/m$^2$ was obtained from BAW1006 and the lowest from BAW1008. But longest spike was recorded from BAW1008 and others were similar. The line BAW966 and BAW1008 were superior in grains/spike than other variety/lines. Grain weights were similar in BAW966 and BAW1006. Similar trend was obtained from grain yield but significantly the highest straw yield from BAW1008. The line BAW1008 showed lower grain yield than other variety due to less no. of spikes/m$^2$ and grain weight.

**Sherpur MLT site**

Plant height, straw yield, grain yield and yield contributing characters were significantly influenced by variety and line (Table 8b). The line BAW1006 showed significantly the highest no. of spikes/m$^2$. Similar trend was followed in case of 1000-grain weight, grain yield and straw yield. The highest grain yield was obtained from BAW1008 due to higher grain/spike and 1000-grain weight.

Table 1. Yield and yield contributing characters of newly released wheat lines/varieties (FSRD site, Palima, Tangail during 2002-03)

| Varieties /Lines | Days to maturity | Plant height (cm) | Spike length (cm) | No. of spike/ m$^2$ | No. of grain/ spike | 1000-grain wt. (g) | Grain yield ( t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| Kanchan | 107a | 98.87 | 8.15 | 235d | 56a | 43.14c | 3.33c | 4.00b |
| BAW966 | 102c | 97.80 | 11.43 | 297b | 55a | 40.43d | 3.83ab | 4.33ab |
| BAW1006 | 105b | 95.43 | 12.20 | 330a | 47b | 50.32b | 3.70bc | 4.17ab |
| BAW1008 | 108a | 98.37 | 13.10 | 276c | 57a | 55.49a | 4.17a | 4.67a |
| CV% | 1.01 | 27.71 | 24.79 | 1.12 | 5.84 | 1.25 | 6.38 | 8.01 |

Table 2. Yield and yield attributes of bread wheat variety/lines at Chandina, Comilla, rabi 2002-03

| Variety/line | Maturity (days) | Plant height (cm) | Effective tiller/plant | Length of spike (cm) | 1000-grain wt. (g) | Grain yield (t/ha) |
|---|---|---|---|---|---|---|
| Kanchan | 110 | 96.57 | 3.4 | 40.87 | 38.43 | 3.72 |
| BAW-966 | 103 | 97.57 | 3.5 | 45.77 | 38.47 | 4.41 |
| BAW-1006 | 106 | 99.87 | 4.3 | 42.37 | 45.40 | 4.37 |
| BAW-1008 | 110 | 100.20 | 4.2 | 44.63 | 42.83 | 4.32 |
| LSD (0.05) | NS | NS | NS | NS | 1.25 | 0.50 |

Table 3a. Performance of yield and yield contributing characters of Wheat varieties at MLT site, Sujanagar, Pabna during 2002-03

| Treatment | Days to maturity | No. of grains/ spike | 1000-grain wt. (g) | Grain yield (t/ha) |
|---|---|---|---|---|
| Kanchan | 109 | 36b | 41.90c | 3.36a |
| BAW-966 | 104 | 47a | 36.03d | 3.22a |
| BAW-1006 | 110 | 37b | 47.63b | 3.37a |
| BAW-1008 | 112 | 39b | 49.94a | 3.28a |
| CV (%) | | 7.7 | 2.0 | 10.2 |

Table 3b. Performance of yield and yield contributing characters of Wheat varieties at MLT site, Goyeshpur, Pabna during 2002-03

| Treatment | Days to maturity | No. of grains/ spike | 1000-grain wt. (g) | Grain yield (t/ha) |
|---|---|---|---|---|
| Kanchan | 112 | 34b | 36.10c | 2.71a |
| BAW-966 | 105 | 28b | 35.67c | 2.41a |
| BAW-1006 | 113 | 43a | 46.99b | 3.37a |
| BAW-1008 | 115 | 39a | 50.45a | 2.83a |
| CV (%) | | 16.9 | 4.0 | 16.8 |

Table 4a. Yield and yield contributing characters of different advance lines/varieties of wheat at Nilphamari MLT site of OFRD, Rangpur during rabi 2002-03

| Treatment | Days to maturity | Plant height (cm) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 114 | 107a | 325 | 38 | 47.2c | 4.19b | 5.96 |
| BAW-966 | 113 | 100c | 331 | 44 | 37.6b | 4.66ab | 6.49 |
| BAW-1006 | 114 | 101bc | 332 | 42 | 47.0b | 4.79ab | 6.66 |
| BAW-1008 | 113 | 106a | 337 | 41 | 50.3a | 4.98a | 6.74 |
| CV (%) | 0.7 | 3.0 | 5.4 | 6.4 | 1.0 | 6.2 | 7.2 |

Table 4b. Yield and yield contributing characters of different advance lines/varieties of wheat at Polashbari MLT site of OFRD, Rangpur during rabi 2002-03

| Treatment | Days to maturity | Plant height (cm) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 115 | 108 | 325 | 31c | 46.5c | 3.87c | 5.98 |
| BAW-966 | 113 | 107 | 337 | 38ab | 37.2b | 4.15bc | 6.44 |
| BAW-1006 | 114 | 107 | 333 | 36b | 47.7b | 4.65b | 6.50 |
| BAW-1008 | 113 | 104 | 341 | 41a | 50.0a | 5.27a | 6.70 |
| CV (%) | 0.7 | 3.0 | 5.5 | 5.5 | 1.1 | 6.4 | 8.1 |

Table 5. Yield and yield contributing characters of different advance lines/varieties of wheat at Mymensingh Sadar during rabi 2002-03

| Treatment | Plant height (cm) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|
| Kanchan | 93.5c | 262 | 35b | 44.7b | 3.58b | 6.00b |
| BAW-966 | 105.4a | 256 | 40a | 42.0c | 3.70b | 5.47b |
| BAW-1006 | 96.6b | 267 | 42c | 50.0a | 3.60b | 6.87a |
| BAW-1008 | 98.0ab | 258 | 41a | 46.7b | 4.28a | 7.55a |
| CV (%) | 1.01 | 4.5 | 3.4 | 2.7 | 9.86 | 6.20 |

Table 6a. Yield and yield contributing characters of different advance lines/varieties of wheat at Shubra MLT site, Dinajpur during rabi 2002-03

| Treatment | Days to maturity | Plant height (cm) | Spike length (no.) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| Kanchan | 113a | 105 | 10.0b | 340 | 40bc | 51.78c | 3.60c | 4.63b |
| BAW-966 | 104ab | 103 | 9.8b | 339 | 44b | 38.32c | 4.06b | 5.40a |
| BAW-1006 | 107ab | 103 | 9.8b | 344 | 38c | 46.22c | 4.33ab | 5.33a |
| BAW-1008 | 104b | 101 | 12.6a | 299 | 52a | 52.06a | 4.66a | 5.30a |
| CV (%) | 2.55 | 3.53 | 4.61 | 7.46 | 4.1 | 3.14 | 5.26 | 4.48 |

Table 6b. Yield and yield contributing characters of different advance lines/varieties of wheat at Boda MLT site, Dinajpur during rabi 2002-03

| Treatment | Days to maturity | Plant height (cm) | Spike length (no.) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| Kanchan | 111a | 97.7a | 10.37b | 236a | 43c | 42.0c | 2.74b | 3.75 |
| BAW-966 | 100c | 92.57b | 10.63b | 240a | 50b | 39.3c | 2.84b | 3.67 |
| BAW-1006 | 107ab | 96.3ab | 11.00b | 252a | 42c | 47.0b | 2.94b | 3.95 |
| BAW-1008 | 103bc | 93.5ab | 13.00a | 208b | 54a | 52.7a | 3.33a | 4.10 |
| CV (%) | 2.48 | 2.45 | 5.94 | 4.62 | 3.11 | 3.29 | 4.5 | 7.02 |

Table 7a. Performance of wheat varieties/lines at Magura MLT site during rabi 2002-03

| Treatment | Plant height (cm) | Spike length (no.) | Spike/m$^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 99.53b | 9.14ab | 293ab | 38a | 36.73c | 2.76b | 3.92b |
| BAW-966 | 99.90b | 10.34a | 315a | 40a | 42.00b | 3.33a | 4.23b |
| BAW-1006 | 99.43b | 8.27b | 310a | 32b | 37.67b | 2.88b | 4.40ab |
| BAW-1008 | 102.00a | 10.23a | 277b | 37a | 48.57a | 3.26a | 4.92a |

Table 7b. Performance of wheat varieties/lines at Chowgacha MLT site, Jessore during rabi 2002-03

| Treatment | Plant height (cm) | Spike length (no.) | Spike/$m^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 90.00b | 9.37b | 402a | 39a | 35.00d | 3.67b | 4.75b |
| BAW-966 | 96.33a | 9.63a | 375a | 41a | 41.10b | 4.13a | 5.03b |
| BAW-1006 | 91.07b | 9.33b | 399ab | 33b | 37.23c | 3.77b | 5.05b |
| BAW-1008 | 91.33b | 9.50ab | 382ab | 38a | 49.17a | 4.03a | 5.81a |

Table 8a. Yield and yield contributing characters of Wheat at MLT site, Melandah during 2002-03

| Treatment | Plant height (cm) | Spike length (no.) | Spike/$m^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 97.81a | 8.30b | 337b | 35c | 44.67b | 3.60c | 5.52b |
| BAW-966 | 94.07b | 8.23b | 328b | 38a | 54.29a | 3.95a | 4.85c |
| BAW-1006 | 99.77a | 8.77b | 368a | 36bc | 52.67ab | 3.63ab | 5.15bc |
| 0BAW-1008 | 98.87a | 11.77a | 296c | 37ab | 43.33b | 3.54b | 6.23a |
| F-test | * | ** | * | ** | ** | * | * |
| CV (%) | 8.91 | 10.46 | 9.51 | 12.43 | 12.24 | 6.53 | 11.64 |

Table 8b. Yield and yield contributing characters of Wheat at MLT site, Sherpur during 2002-03

| Treatment | Plant height (cm) | Spike length (no.) | Spike/$m^2$ (no.) | Grains/ Spike (no.) | 1000-grain wt. (g) | Grain yield (t/ha) | Straw yield (t/ha) |
|---|---|---|---|---|---|---|---|
| Kanchan | 100.53bc | 10.03ab | 348b | 33c | 39.67c | 3.00c | 4.45c |
| BAW-966 | 99.34c | 9.40b | 349b | 36b | 33.33d | 4.00b | 5.28b |
| BAW-1006 | 101.90a | 10.13ab | 396a | 35bc | 43.67b | 4.23b | 5.63b |
| BAW-1008 | 100.80ab | 10.87a | 289c | 42a | 49.33a | 5.13a | 6.65a |
| F-test | * | * | * | ** | * | ** | ** |
| CV (%) | 7.63 | 5.07 | 11.39 | 10.62 | 12.13 | 9.18 | 8.03 |

# PERFORMANCE OF WHEAT THROUGH POWER SEEDER COMPARE TO TRADITIONAL METHOD

## Introduction

Wheat (*Triticum aestvum*) is the second major cereal crop next to rice, cultivated during rabi season in Bangladesh. It has to compete with other important winter crops like pulses, oil seeds and vegetables. Due to higher cost of production of wheat it can not compete with above mentioned crops. Production cost of wheat, ploughing cost is major. CIMMYT developed a power seeder, which is able to furrow, line sowing and leveling of soil at a time. It reduce seed rate (20%), $^{1}/_{3}$rd production cost and yield increased (20-30%) of wheat over traditional broadcast method. Therefore, collaboration with CIMMYT and BARI conducted a production program of wheat to see the comparative performance in between mechanical and traditional method.

## Materials and Methods

A cultivation program was conducted at the BARI Technology Village, Puspapra, Pabna during 2001-02 and 2002-03 and FSRD site, Syedpur, Rangpur to compare the traditional practice of wheat production with mechanical method. Before starting the program a motivational meeting was organized for successful implementation of the program. Fourteen cooperator farmers were selected in same land categories. The production program covered 4.00 hectares of land. Wheat variety Protiva in 2001-02 and Shatabdi at 2002-03 was sown through power seeder and Kanchan was sown in traditional broadcast method at Pabna but Protiva at Rangpur during 2002-03. The crop was fertilized at the rate of 200-150-50-120-7.5-7.5 kg Urea-TSP-MP-Gypsum-Zincoxide and Borax/ha. The seeds were sown on 7 December 2001 and 10-14 December 2002 at Pabna and 3-5 December 2002 at Rangpur. Intercultural operation and plant protection measures were done as and when required. Crop was harvested on 22-27 March 2002 and 3-5 April 2003 at Pabna and 26-31 March 2003 at Rangpur.

## Results and Discussion

### Pabna site

During 2001-02, the highest grain yield (2.32 t/ha) was obtained where mechanical seeder was used for wheat cultivation which was 4% higher than traditional broadcast method. Gross return (Tk.21885/ha), gross margin (Tk.11310/ha) and benefit cost ratio (2.06) were obtained from mechanical seeding method.

In 2002-03, the highest grain yield (3.44 t/ha) was obtained from mechanical seeding which was % higher than traditional broadcast (2.22 t/ha) method. Economic point of view, higher gross return (Tk. 33075/ha), gross margin (Tk.21480/ha) and benefit cost ratio (2.85) were obtained from mechanical seeding reduced and higher profit could be possible compare to traditional production method.

### Rangpur site

The higher grain yield was obtained where power seeder was used which was 40% higher than traditional broadcast method. The gross return, gross margin and BCR (2.45) were obtained from power seeding method.

## Conclusion

Wheat seeding through mechanical seeder was an improved method for wheat cultivation. Moreover, the method was easy, profitable and minimized the turn around time. So, the program can be recommended for large-scale extension at farmers' field.

*AT*

**Farmers' reaction**

Farmers showed very much positive response with new mechanical seeder. They expressed their satisfaction with less production cost and recover the turn around time and they also opined that the price of seeder is too high.

Table 1. Comparative performance of Wheat in between power seeder and traditional production method in 2001-02

| Method | No. of monitored farmers | Area covered (ha) | Grain yield (t/ha) | Stover yield (t/ha) | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|---|---|---|
| Seeding with power seeder | 5 | 2.15 | 2.32 | 4.13 | 21885 | 10575 | 11310 | 2.06 |
| Traditional broadcast method | 5 | 2.15 | 2.25 | 3.95 | 21100 | 11607 | 9493 | 1.81 |

Table 2. Comparative performance of Wheat in between power seeder and traditional production method in 2002-03

| Method | Variety used | No. of monitored farmers | Area covered (ha) | Grain yield (t/ha) | Stover yield (t/ha) | Gross return (Tk./ha) | TVC (Tk./ha) | Gross margin (Tk./ha) | BCR |
|---|---|---|---|---|---|---|---|---|---|
| Seeding with power seeder | Shatabdi | 7 | 2.0 | 3.44 | 4.23 | 33075 | 11595 | 21480 | 2.85 |
| Traditional broadcast method | Kanchan | 7 | 2.0 | 2.22 | 2.89 | 21425 | 12765 | 8660 | 1.68 |

Table 3. Comparative performance of wheat (var. Protiva) in between power seeder and traditional production method

| Method | No. of farmers involved | Area covered (ha) | Grain yield (t/ha) | Straw yield (t/ha) | Gross return (Tk/ha) | TVC (Tk/ha) | GM (Tk/ha) | BCR |
|---|---|---|---|---|---|---|---|---|
| Seeding with power seeder | 8 | 2.0 | 3.86 | 4.54 | 33150 | 13509 | 19641 | 2.45 |
| Traditional broadcast method | 5* | 1.25 | 2.33 | 3.53 | 22005 | 14528 | 5877 | 1.40 |

* No. of monitored farmers

# ON-FARM VERIFICATION TRIAL OF HYBRID MAIZE


## Abstract

Five varieties/lines (BM TOP-2, BFC 101, CMS 933084, CMT 975032 and Pacific) were evaluated at Jhenaidah, Tangail and Pabna site during 2002-03. At Jhenaidah, Significantly the highest grain yield was obtained from CMS 93304 due to the highest ear height, grains/cob and grain weight but at Palima, Tangail Pacific-983 showed the highest yield among the varieties.


## Introduction

Bangladesh Agricultural Research Institute has recently released a hybrid maize variety BARI hybrid maize-1. Besides this, some other advance lines were identified. The variety /line is said to be higher yielder. It was felt necessary to evaluate the performance of the said variety across the locations all over the country. Considering above the present study was initiated with the following objectives i) to observe the yield potential of BARI hybrid maize-1 compared to the check varieties and ii) to select the suitable hybrid maize variety(s) for Jhenaidah & Tangail region.

## Materials and Methods

The experiment was conducted at FSRD site, Palima, Tangail, Goyeshpur, Pabna and MLT site, Jhenaidah during rabi seasons of 2002-03. The experiment was laid out in Randomized Complete Block Design with three replications. The unit plot measured 4.5 m x 5.0 m. Four advanced lines of hybrid maize viz. CMS933084, BM Top-2, CMS975032 and Pacific-983 (Imported) were included in the study. The crop was fertilized with 250-120-170-40-5 kg N-$P_2O_5$-$K_2O$-S-Zn/ha. One-third N and all other fertilizers were applied as basal. The remaining N was applied as top-dress in two equal splits at 8-12 leaf stage and at tasseling stage. The seeds were sown on Nov. 20, 2002 at Jhenaidah, 22 December 2002 at Tangail and 22 December at Pabna. The seeds were sown maintaining a spacing of 75 cm x 25 cm with seed rate 20 kg/ha. Irrigation and other intercultural operations were done as and when necessary. The varieties/advance lines took around 160 and 90 days to maturity. The crop was harvested on 21-24 April 2003 at Jhenaidah, 14 May 2003 at Tangail and 25 May 2003 at Pabna. Data on the yield and yield contributing characters were recorded and analyzed statistically.

## Results and Discussion

### MLT site, Jhenaidah

Plant height, yield and yield attributes were significantly influenced by variety. Significantly highest plant height was recorded from CMS 933084 and the lowest from Pacific-983. The higher no. of grains/cob was also produced by CMS933084 but at par to Pacific-983 and BM Top-2. The highest grain weight was obtained from CMS 933084 but statistically identical to Pacific-983 & BFC 101. Significantly the highest grain yield was obtained from CMS 933084 due to higher length of cob, grain/cob and 100-grain weight. All the variety/line showed much higher yield as compared to other parts of the country.

### FSRD site, Palima, Tangail

Plant height, yield and yield attributes were significantly influenced by different variety/line. The highest physiological maturity (143 days) was obtained from Pacific 983 & the lowest (136 days) from CMT 975032. Significantly the highest plant height was obtained from CMS 99084. Similar in case of ear height. Cob length differed significantly where higher length was recorded from CMT 975032 which was at par to CMS 933084. Significantly the highest width of cob was obtained from Pacific 983 but the Pacific 983 and CMS 933084 showed similar grain weight. Significantly the highest grain yield was produced by Pacific 983.

**FSRD site, Goyeshpur, Pabna**

Days to maturity, plant height, yield and yield attributes were significantly affected by variety/line. More days required to BFG 101 and shortest days to Pacific-983. Significantly the highest plant recorded from BHM-2 similar trend was followed in case of ear height but grains/cob was statistically identical to all variety/line. Significantly the highest grain weight was obtained from BGM-2 grain yield was higher from BHM-2 which was statistically identical to Pacific-983, BFC-101 and CMT-975032 but stover yield was significantly the highest from variety BHM-2.

From the study it was revealed that variety Pacific 983 superior at Tangail but CMS 933084 at Jhenaidah and BHM-2 at Pabna than other varieties/lines but for confirmation it needs further another year trial for conclusion.

Table 1. Yield and yield components as influenced by hybrid maize varieties were tested at MLT site, Jhenaidah during 2002-03

| Varieties | Plant height (cm) | Ear height (cm) | Length of cob (cm) | No. of grains/cob | 100-grain wt. (g) | Grain yield (t/ha) |
|---|---|---|---|---|---|---|
| Pacific 983 | 179.9c | 81.23c | 17.13bc | 541.2a | 38.37ab | 11.16b |
| CMS933084 | 219.7a | 120.9a | 17.80abc | 549.5a | 39.25a | 12.92a |
| BFC 101 | 188.9bc | 85.50c | 16.97c | 454.3b | 37.95abc | 10.32b |
| BMTOP 2 | 202.1b | 101.9b | 18.27ab | 507.6ab | 37.40bc | 11.13b |
| CMT 975032 | 189.1bc | 85.70c | 18.73a | 449.7b | 36.72c | 10.90b |
| CV (%) | 6.87 | 9.59 | 5.51 | 9.21 | 3.26 | 9.82 |

Table 2. Yield and yield contributing characters of hybrids Maize at FSRD site Palima, Tangail during 2002-03

| Varieties/lines | Days to maturity | Plant height (cm ) | Ear height (cm) | Cob length (cm) | Cob breadth (cm) | 1000-grain wt. | Grain yield (t/ha ) |
|---|---|---|---|---|---|---|---|
| BM Top-2 | 139 | 241.9b | 94.47b | 20.43bc | 15.32b | 360.0b | 5.52b |
| BFC 101 | 137 | 233.1bc | 88.03b | 20.27bc | 15.52b | 369.0b | 10.00b |
| CMS 933084 | 141 | 275.3a | 101.1a | 21.17ab | 15.15b | 396.0a | 10.08b |
| CMT 975032 | 136 | 232.9bc | 88.27b | 22.13a | 15.35b | 364.8b | 9.25b |
| Pacific 983 | 143 | 230.2c | 93.17 b | 19.72c | 17.15a | 386.5a | 11.68a |
| CV (%) | | 3.23 | 9.21 | 4.24 | 3.43 | 3.79 | 9.03 |

Table 3. Yield and yield contributing characters of hybrids Maize at FSRD site Goyeshpur, Pabna during 2002-03

| Varieties/ ines | Days to maturity | Plant height (cm ) | Ear height (cm) | Grain/ cob (no.) | 1000-grain wt. | Grain yield (t/ha ) | Stover yield (t/ha) |
|---|---|---|---|---|---|---|---|
| BM Top-2 | 147a | 192.03b | 87.57b | 438.05a | 301.53b | 6.91b | 8.12b |
| BFC 101 | 149ab | 189.03bc | 77.10c | 464.80a | 304.13b | 7.80ab | 8.10b |
| CMT 975032 | 147ab | 187.73bc | 77.60c | 451.04a | 313.33b | 7.22ab | 8.09b |
| BHM-2 | 149ab | 226.47a | 104.53a | 440.99a | 343.80a | 8.19a | 10.41a |
| Pacific 983 | 146b | 179.73c | 76.17c | 498.08a | 310.93b | 8.21a | 8.43b |
| CV (%) | 1.4 | 4.3 | 6.8 | 14.1 | 5.3 | 11.8 | 12.2 |

# ON-FARM TRIAL OF RADISH VARIETIES


## Abstract

An on-farm trial was conducted at FSRD site Palima, Tangail, Atkapalia, Noakhali, Narikeli, Jamalpur, Golapganj, Sylhet, MLT site, Sunamganj in 2001-03 Moulvibazar and Faridpur during rabi 2002-03 to observe the performance of newly developed radish varieties BARI Radish-2 (Pinky) and BARI Radish-3 (Druti) at different farmers' fields. At Palima, the variety Pinky and Druti showed average yield of 41.71 and 50.2 t/ha, respectively but Tasakisan variety showed higher yield (49.26 t/ha) among the variety during 2002-03. Higher gross return and margin was recorded from variety Druti and also higher benefit cost ratio from the same but higher BCR from Tasakisan in 2002-03. At Noakhali, higher yield from Tasakisan followed by pinky and similar trend in BCR. At Jamalpur, there was no difference in yield between two varieties but Pinky showed higher yield at Golapganj, Sunamganj and Moulvibazar during 2002-03.


## Introduction

Radish is a winter vegetable in our country. It is widely grown vegetable in Bangladesh. BARI has already released three improved radish varieties which are grown in specific areas. On the other hand, normally the developed varieties in the farmer's field under cultivation gradually degenerate overtime. So, it is necessary to replace it by new one. Therefore, newly released variety was put under trial at different locations for their adaptability and acceptability at farmers' level.

## Materials and Methods

The trial was conducted at FSRD site Palima, Tangail, Atkapalia, Noakhali, Jamalpur and Golapganj, Sunamganj, Sylhet MLT site, during rabi 2001-03, Moulvibazar and Faridpur during 2002-03. BARI Radish-2 and BARI Radish-3 were used. The unit plot size was 200 sq.m for each variety. One demonstration plot constituted 2 unit plots. Plot to plot distance was 75 cm and plant spacing was 30 cm x 30 cm with two seeds/hill at the seed rate of 50 g/200sq.m$^2$. Seeds were sown in 1$^{st}$ week of November at Palima, Tangail, November 18 to December 5 at Noakhali and 24-30 October 2002 at Jamalpur, 20-24 November at Golapganj and 25 October-8 November at Sunamganj and 5 November at Faridpur. The fertilizer were applied at the rate of 10 t/ha cowdung and 375 -155-255 kg/ha of urea, TSP and MP. The entire quantity of cowdung, TSP and half of urea and MP were applied during land preparation. The rest of urea and MP are to be applied as top dressing after 20 and 30 days of sowing. Intercultural operations such as weeding and irrigation were done whenever required but rainfed at Noakhali. The crop was harvested at marketable size from 12-14 December 2003 at Jamalpur and 25 December 2002 to 5 January 2003 at Faridpur and late December to late January at Noakhali. Observations were made on root weight/plant (g), root yield (t/ha) and farmer's reaction.

## Result and Discussion

### Site: Palima, Tangail

The data on yield and yield components of radish varieties are presented in Table 1. Average root height of Pinky and Druti were 23.34 and 25.46 respectively. Average root weight and root yield without leaf of Pinky variety were 415 g/plant and 46.11 t/ha. On the other hand, average root weight and root yield without leaf of Druti variety were 461.60 g/plant and 51.30 t/ha .On an average, higher root height and root weight was recorded from the variety Druti which reflected higher yield in 2001-02. During 2002-03, the variety Tasakisan was included which showed higher yield due to higher root length, root breadth and root weight. Gross return and margin was higher from the variety Druti. But due to higher yield and price, higher benefit cost ratio was obtained from the variety Druti in 2001-02 but higher BCR was recorded from Tasakisan during 2002-03.

### Site: Atkapalia, Noakhali

Root length, root weight were significantly influenced by different varieties but yield was insignificant in 2001-02 but significant during 2002-03 (Table 2). Significantly the highest root length was obtained from Tasakisan but root weight between Druti and Tasakisan were statistically identical. There was no significant difference was found in different variety but slightly higher yield from Druti in 2001-02 but higher yield from Tasakisan followed by Druti in 2002-03. The highest gross return was recorded from Tasakisan which also showed higher benefit cost ratio which closely followed by Pinky. Yield was lower than other site, that the experiment was conducted at Charland under rainfed conditions.

**Site: Jamalpur and Sylhet**

Root weight/plant, no. of root/$m^2$ and root yields was statistically identical at Jamalpur (Table 3). At Golapganj higher yield was obtained from Druti in 2001-02 but in 2002-03 from Pinky but at Sunamganj the highest yield from pinky (on average) and similar trend was followed at Moulvibazar in 2002-03.

**Site: Ishan Gopalpur, Faridpur**

Plants/$m^2$, root length and diameter was not varied among two varieties but weight & root was the highest from Pinky. Root yield also produced the highest from Pinky which showed the highest yield among all the sites under studied.

**Farmers' reaction**

- Farmers were very much interested to cultivate Druti variety for its colour and market price. But farmers are interested to cultivate Pinky for its attractive colour, taste and higher market price.
- They react positively to cultivate this vegetable in next season if seeds are available in proper time.
- Market price of Pinky is less than Druti for its red colour.
- Farmers of Faridpur site preferred for its big size, fibreless, tasty, higher yield and store can be done easily.

Table 1. Yield, yield attributes and cost benefit analysis (average) of Radish at Palima, Tangail during 2002-03

| Variety | Root length (cm) | Root breath (cm) | Root wt.(g) /plant | Root yield (t/ha) | | Gross return (Tk./ha) | TVC (Tk./ha) | BCR | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 01-02 | 02-03 | | | 01-02 | 02-03 |
| Druti | 19.30 | 17.27a | 368.3b | 51.30 | 41.25b | 130390 | 33573 | 4.75 | 3.88 |
| Pinky | 17.13 | 15.57b | 298.3c | 46.11 | 37.31b | 98735 | 33573 | 3.66 | 2.94 |
| Tasakisan | 22.73 | 17.40a | 441.8a | - | 49.26a | 130740 | 33573 | - | 3.89 |
| CV% | 14.16 | 2.55 | 4.37 | | 4.34 | | | | |

**Price (Tk./kg):** Pinky= 2.50, Druti = 3.00

Table 2. Yield, yield attributes and cost benefit analysis (average) of Radish at Atkapalia, Noakhali during 2002-03

| Variety | Root length (cm) | Root wt. (g) | Root yield (t/ha) | | TVC (Tk./ha) | Gross return (Tk./ha) | BCR | |
|---|---|---|---|---|---|---|---|---|
| | | | 2001-02 | 2002-03 | | | 2001-02 | 2002-03 |
| Druti | 20.72a | 361.7a | 16.94 | 36.20a | 30215 | 126700 | 2.24 | 4.19 |
| Pinky | 19.27ab | 332.1a | 17.30 | 31.70ab | 30215 | 110950 | 2.32 | 3.67 |
| Tasakisan | 17.69b | 266.4b | 17.19 | 26.48b | 30215 | 105920 | 2.88 | 3.5 |
| LSD (0.05) | 2.66 | 1.47 | ns | 8.57 | | | | |
| CV (%) | 7.99 | 10.91 | 34.88 | 15.74 | | | | |

**Price (Tk./kg):** In 2001-02, Druti= 4.00, Pinky= 5.00 and Tasakisan= 4.00
In 2002-03, Druti= 3.50, Pinky= 4.00 and Tasakisan= 3.50

Table 3. Root weight and no. of root and root yield of radish at Jamalpur and Sylhet in 2002-03

| Variety | Root wt./plant (g) | No. of roots/$m^2$ | Root yield (t/ha) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Jamalpur | | Golapganj | | Sunamganj | | Moulvibazar |
| | | | 01-02 | 02-03 | 01-02 | 02-03 | 01-02 | 02-03 | 02-03 |
| Pinky | 420 | 12 | 55 | 46.5 | 51 | 52 | 54 | 64 | 46 |
| Druti | 401 | 12 | 56 | 45.0 | 56 | 38 | 42 | 48 | 32 |

Table 4. Yield and yield attributes of radish varieties at Ishan Gopalpur, Faridpur during rabi 2002-03

| Variety | Plants/$m^2$ | Root length (cm) | Root diameter (cm) | Weight of root/plant (g) | Root yield |
|---|---|---|---|---|---|
| Pinky | 14.0 | 21.3 | 5.83 | 638 | 89.4 |
| Druti | 14.2 | 20.3 | 5.21 | 472 | 67.2 |

# ON-FARM TRIAL OF TOMATO VARIETIES


## Abstract

The experiment was conducted during Rabi season of 2002-03 at the FSRD site, Ishan Gopalpur, Faridpur, Golapganj, Sylhet and MLT site Sunamganj & Moulvibazar, and Lebukhali, Patuakhali. On an average, results showed that BARI Tomato-7 gave higher yield (87.3 t/ha) at Ishan Gopalpur, BARI Tomato-8 at Golapganj (87.0 t/ha), Moulvibazar (91.0 t/ha), Sunamganj (105.0 t/ha), and Patuakhali (20.5 t/ha), respectively.


## Introduction

Tomato is a good source of vitamin and it is grown as a winter vegetable. In the year 1996-97 the cultivation of tomato was thirteen thousand ha, and the total tomato production was 93 thousand ton. Tomato has contained a rich amount of protein, calcium, vitamin 'A' and vitamin 'C'. In Bangladesh a large number of children have been suffering from blind disease due to the deficit of vitamin 'A'. In cause of nutrition value tomato is a very important vegetables. Tomato is the most economic vegetable crop, which is commercially grown in many areas of Bangladesh. Hence there is a need to study the performance of the existing varieties at farmers' field at different location of Bangladesh.

## Materials and Methods

The experiment was conducted at the FSRD site, Ishan Gopalpur, Faridpur, Golapganj, Sylhet and MLT site Sunamganj and Moulvibazar and Patuakhali, respectively during Rabi season in 2001-03. A discussion meeting was arranged with co-operator farmers for implementation of the program. The site team supplied good quality seeds of BARI Tomato-2, 6, 7 and 8 to the farmers. Six farmers were selected and each farmers plot was considered as one replication. The treatment imposed on each replication was four BARI tomato varieties during 2001-02 but six varieties in 2002-03. The experiment was laid out in RCB design with six dispersed replications. The unit plot size was 4.8 m x 1.0 m. Twenty-thirty days old seedling were planted on 29 Nov., 21-28 Nov., 2-5 Nov., and 1-4 Dec. at Ishan Gopalpur, Goyeshpur, Golapganj, Sunamganj and Moulvibazar and 2$^{nd}$ week of October, 2002 at Patuakhali was 60 cm x 40 cm. The crop was fertilized with cowdung 10 t/ha and Urea TSP and MP at the rate of 550-450-250 kg/ha. Half quantity of cowdung and full dose of TSP were applied as basal during final land preparation. Remaining cowdung was applied during pit preparation. The Urea and MP were applied in two equal splits at 21 and 35 days after seedling transplantation. Dimecron/Ridomil/Diethane was applied at 25 and 40 days after seedling transplantation and other intercultural operation were done as and when necessary. Harvesting started at 20 February 2002 & 25 February 2003 and harvesting competed on 1$^{st}$ week in both the years at Ishan Gopalpur.

## Results and Discussion

### Site: Ishan Gopalpur, Faridpur

Only fruit/plant, yield/plant and yield (t/ha) was recorded which showed significant influenced by different variety. The variety BARI Tomato-7 showed higher fruit weight. Significantly the highest yield/plant was recorded from BARI Tomato-7. Similar trend was followed in yield (t/ha). Higher yield was obtained from BARI Tomato-7. On an average, the highest yield was obtained form BARI Tomato-7.

### Site: Golapganj, Sunamganj and Moulvibazar, Sylhet

Statistical analysis was not done is any of the characters. From average mean data it showed that at BARI Tomato-8 performed better at Golapganj, Moulvibazar and Sunamganj.

**Site: Lebukhali, Patuakhali**

The result showed that no. of fruits/plant, yield/plant and yields were significantly influenced by variety. Significantly the highest fruits/plant was obtained from BARI Tomato-7 followed by BARI Tomato 9 & 6. But BARI Tomato-8 showed significantly the highest yield/plant. This resulted the highest yield in BARI Tomato-8 and significantly different from other variety.

From the above result it showed that BARI Tomato-7 gave higher yield at Ishan Gopalpur, but BARI Tomato-8 at Golapganj, Moulvibazar, at Sunamganj and Lebukhali, Patuakhali, respectively.

**Farmers' reaction**

Yield and market price of all four varieties are satisfactory, tasty and preferred by the farms of Patuakhali region.

Table 1. Comparative yield performance of different Tomato varieties at different location in rabi, 2002-03

| Location | Variety | Fruit wt. (gm) | Fruits/plant (no.) | Yield/plant (kg) | Fruit yield (t/ha) | |
|---|---|---|---|---|---|---|
| | | | | | 2001-02 | 2002-03 |
| Ishan Gopalpur, Faridpur | BARI Tomato-2 | 76.8bc | 26 | 2.03b | 69.22b | 62.8b |
| | BARI Tomato-3 | 61.8d | 28 | 1.61c | - | 48.0d |
| | BARI Tomato-6 | 62.5b | 29 | 1.77c | 71.75b | 52.3c |
| | BARI Tomato-7 | 95.8a | 23 | 2.33a | 103.22a | 71.3a |
| | BARI Tomato-8 | 71.8c | 25 | 1.63c | 79.02b | 48.5cd |
| | CV (%) | 3.1 | | 7.4 | 11.4 | 4.5 |
| Golapganj | BARI Tomato-2 | 82 | 35 | 2.87 | - | 89 |
| | BARI Tomato-3 | 105 | 27 | 2.83 | - | 86 |
| | BARI Tomato-6 | 85 | 32 | 2.72 | 74.0 | 78 |
| | BARI Tomato-7 | 124 | 26 | 3.22 | 51.9 | 97 |
| | BARI Tomato-8 | 116 | 30 | 3.48 | 62.9 | 111 |
| | BARI tomato 12 | 89 | 25 | 2.23 | 40.1 | 67 |
| Sunamganj | BARI Tomato-2 | 84 | 28 | 2.35 | - | 72 |
| | BARI Tomato-3 | 95 | 27 | 2.56 | - | 79 |
| | BARI Tomato-6 | 84 | 23 | 1.93 | 65.8 | 61 |
| | BARI Tomato-7 | 115 | 25 | 2.87 | 61.6 | 94 |
| | BARI Tomato-8 | 108 | 35 | 3.78 | 93.2 | 116 |
| | BARI Tomato-12 | 95 | 22 | 2.09 | 33.4 | 59 |
| Moulvibazar | BARI Tomato-2 | 80 | 24 | 1.92 | - | 62 |
| | BARI Tomato-3 | 90 | 28 | 2.52 | - | 75 |
| | BARI Tomato-6 | 81 | 20 | 1.62 | 59.5 | 52 |
| | BARI Tomato-7 | 118 | 25 | 2.95 | 51.3 | 90 |
| | BARI Tomato-8 | 99 | 32 | 3.16 | 86.5 | 96 |
| | BARI Tomato-12 | 84 | 19 | 1.60 | - | 48 |
| Lebukhali | BARI tomato-6 | | 23ab | 1.94b | 63.0b | 64.2b |
| | BARI tomato-7 | | 26a | 1.89b | 64.0b | 63.6b |
| | BARI tomato-8 | | 21b | 2.15a | 70.0a | 70.5a |
| | BARI tomato-9 | | 25a | 1.71b | - | 61.5b |
| | BARI Tomato-11 | - | - | - | 62.0b | - |

# ON-FARM TRIAL OF EARLY BRINJAL VARIETY


## Abstract

The experiment was conducted at Farming System Research and Development (FSRD) site, Atkapalia, Noakhali and Lebukhali, Patuakhali in rabi 2001-03 with released three Brinjal variety viz. Kazla, Uttara and local at Noakhali and Kazla and Nayantara at Patuakhali to observe their performance at farmers' field. Under normal cultivation practice the highest yield (37 t/a) and BCR (3.84) was obtained from Uttara variety at Noakhali but Kazla showed better performance at Patuakhali


## Introduction

Cultivation of vegetables is very low in Noakhali and Patuakhali site. It is a vegetable deficit area mainly for two reasons- (i) lack of vegetable cultivable land and (ii) farmers use local varieties. As a result production and quality of vegetables are degrading day by day. So, it is necessary to replace local variety. With this view newly released brinjal variety viz. Kazla, Uttara and Nayantara were put under trial at different farmers' field to find out their adaptability and acceptability at farmers level.

## Materials and Methods

The experiment was conducted at FSRD site, Atkapalia, Noakhali in 2002-03 and Lebukhali, Patuakhali during rabi 2001-03. Newly released BARI brinjal variety- Kazla, Uttara & Nayantara were used. The experiment was laid out in RCB design with the three dispersed replication with spacing 30 cm x 30 cm. Seeds were sown seedbed in mid of October and transplanted in the main plot from 26 to 30 November 2002. The unit plot size was 10 to 17.5 $m^2$. Fertilizer doses were as per recommended dose. The entire quantity of cowdung, TSP and half of urea and MP were applied during land preparation. The rest of Urea and MP were top dressed after 20 and 30 days of transplanting. Other intercultural operations were done as per requirement. Harvesting was done from February 2 to 18 April at Noakhali.

## Results and Discussion

### Atkapalia, Noakhali

Fruits/plant, fruits weight and yield were significantly effected by variety. Significantly the highest fruits/plant was recorded from variety Uttara and the lowest from local. But local variety showed the highest weight followed by Kazla. Significantly the highest yield was obtained from benefit cost ratio (3.84).

The trial should be conducted another year for confirmation.

### Lebukhali, Patuakhali

The variety Kazla showed the highest no. of fruits/plant but infected fruit-borer almost same for the two variety. Kazla variety had higher number of fruits/plant. On an average, higher fruit yield was obtained from variety Kazla due to more no. of fruits/plant and yield of fruits.

### Farmers' Reaction

- The variety Kazla showed more popular due to its size, colour and storage ability.
- Disease resistance and taste of Kazla is comparatively better. The variety Nayantara sold higher price due its round shape and size. Both the varieties preferred by the farmers at Lebukhali site.

Table 1. Yield and yield attributes of brinjal at FSRD site, Atkapalia, Noakhali during rabi season of 2002-03

| Treatment | No of fruits/ plant | Each fruit weight (g) | Yield (t/ha) | TVC (Tk.) | Gross return (Tk,) | BCR |
|---|---|---|---|---|---|---|
| Kazla | 24.93b | 53.22ab | 34.31b | 48100 | 171550 | 3.57 |
| Uttara | 27.30a | 49.36b | 36.97a | 48100 | 184850 | 3.84 |
| Local | 15.63c | 60.27a | 29.05c | 48100 | 145250 | 3.02 |
| CV (%) | 4.63 | 7.33 | 2.28 | | | |
| LSD (0.05) | 2.11 | 7.95 | 1.53 | | | |

Figures in column having similar letter do not differ significantly

Table 2. Performance of Brinjal variety-Kazla and Nayantara at Patuakhali during 2002-03

| Variety | No. of fruits/ plant | No. of borer infected fruits/plant | Yield of fruits (kg/plant) | Yield of fruits (t/ha) | |
|---|---|---|---|---|---|
| | | | | 2002-03 | 2001-02 |
| Kazla | 55 | 2.5 | 2.22 | 42.5 | 52 |
| Nayantara | 17 | 2 | 1.80 | 34.3 | 46 |

# DISSEMINATION OF NEWLY IMPROVED VARIETIES OF PANIKACHU

## Materials and Methods

The study was conducted at the MLT site, Keshobpur, Jessore and Jhenaidah to compare the improved varieties with local one. The experiment was laid out in RCBD with 3 replications. The unit plot was 10 m x 10 m. The seedlings were planted on 5 February, 2002 maintaining the spacing of 60 x 45 cm. Fertilizers were applied at the rate of 15 ton cowdung and urea, TSP, MP: 150-125-175 kg/ha. All fertilizers except urea were applied during final land preparation and urea was applied in two equal splits at 30 DAT and 60 DAT. Irrigation and weeding were done as and when necessary. Harvesting continued from 1$^{st}$ week of April to 3$^{rd}$ week of October. Data on plant height, length of stolen, number of stolen/plant, weight of stolen/plant and yield (t/ha) were recorded.

## Results and Discussion

Results were presented in the Table 1. The variety Latiraj produced the highest yield (36.79 t/ha) at Jhenaidah MLT site and it was 29.37 t/ha at MLT site Keshobpur. In the both locations local variety produced the lower yield compared with latiraj. The yields of local variety were 20.56 and 22.32 t/ha at Keshobpur and Jhenaidah MLT site respectively. Higher yield from latiraj was due to higher yield contributing characters.

### Farmers' reaction

Farmers express their satisfaction with more yields of latiraj and they are interested to grow it for its high market price and demand.

Table 1. Performance of yield and yield contributing characters of Panikachu at MLT site, Keshobpur and Jhenaidah during 2002-03

| Locations | Variety | Plant height (cm) | Length of stolen (cm) | Stolen/plant (no.) | Wt. of stolen/ plant (kg) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| Keshobpur | Latiraj | 91.35 | 57.85 | 28.25 | 1.160 | 29.37 |
| | Local | 110.2 | 52.18 | 17.32 | 0.858 | 20.56 |
| Jhenaidah | Latiraj | 96.46 | 59.65 | 30.59 | 1.495 | 36.79 |
| | Local | 114.20 | 49.32 | 20.15 | 0.985 | 22.32 |

# DISSEMINATION OF NEWLY IMPROVED VARIETIES OF MUKHIKACHU

## Materials and Methods

The study was conducted at the MLT site, Keshobpur, and Jhenaidah, Jessore during 2002-2003 to compare the improved variety of Mukhikachu with farmer's own. The experiment was laid out in RCBD with 4 replications. One improved variety Bilashi was tested along with local variety at the both MLT site. The unit plot was 10 m x 10 m. The seeds were sown on 22 April, 2002 maintaining the spacing of 60 cm x 45 cm. Cowdung 15 ton and urea, TSP: 150-125-175 kg/ha were used. All fertilizers except urea were applied during final land preparation and urea were applied in two equal splits at 40 DAS and 90 DAS. Weeding, irrigation, earthing up was done as and when necessary. The crop was harvested on 25 October, 2002. Data on plant height, number of cormel/plant, weight of cormel/plant and yield t/ha were recorded.

## Results and Discussion

Results were presented in the Table 1. It shows that the variety Bilashi is superior to local variety at the both the site considering yield and yield attribute. The highest yield (25.89 and 30.82 t/ha) was obtained from Bilashi at Keshobpur and Jhenaidah, MLT site, respectively. Local variety produced the lowest yield 17.84 t/ha at Keshobpur and 16.50 t/ha at Jhenaidah, MLT site.

### Farmer's reaction

Farmer's are very much interested to grow the Mukhikachu variety Bilashi for its higher yield and market price.

Table 1. Performance of yield and yield contributing characters of Mukhikachu at MLT site, Keshobpur and Jhenaidah during 2002-03

| Locations | Variety | Plant height (cm) | Length of cormel /plant | Wt. of cormel/ plant (kg) | Yield (t/ha) |
|---|---|---|---|---|---|
| Keshobpur | Bilashi | 68.50 | 26.39 | 0.575 | 25.89 |
| | Local | 57.32 | 23.29 | 0.465 | 17.84 |
| Jhenaidah | Bilashi | 70.53 | 28.26 | 0.869 | 30.82 |
| | Local | 59.45 | 21.60 | 0.410 | 16.50 |

# ADAPTIVE TRIAL OF DEVELOPED AND ADVANCE LINES OF GROUNDNUT AT FARMERS' FIELD


## Abstract

The experiment was conducted at farmers' field at Cox's Bazar during November 2002 to April 2003 to evaluate to the performance of developed and advanced lines and local of. (ICGV 89259, BARI Badam 6, Dhaka –1) were tested. The line ICGV 89259 and BARI Badam 6 showed the best performance in context of yield.


## Introduction

BARI has released a number of groundnut varieties and an advanced line was found suitable. These developed and advance lines need to disseminate among the farmers at different locations. Hence the proposed study was taken in hand to compare these with local one at Cox's Bazar in Chittagong region.

## Materials and Methods

The experiment was conducted at farmers field at Cox's Bazar of Chittagong region during November 2002 to April 2003 to evaluate the performance of some varieties/line (ICGV89259, BARI Badam 6, Dhaka-1) of groundnut under farmers' condition. and local were tested. The experiment was conducted in RCB design with five dispersed replications. The groundnut varieties were sown at 19-23 November 2002 and harvested 16-20 April 2003. The unit plot was 50 $m^2$ with spaced 30 cmx15c m. Fertilizer dose was 10:70:50:30:4:2 kg/ha NPKSZn and B, respectively and applied as basal. Data on number of nut per plant, weight of nut per plant and nut yield on 10$m^2$ area basis and analysed statistically.

## Results and Discussion

Yield and yield attribute of groundnut were presented in Table 1. Significantly the highest number of nut per plant was found in ICGV89259. The lowest nut/plant was obtained from local one. Similar trend was obtained in case of weight of nut/plant. The line ICGV 89259 showed higher seed yield but statistically identical to BARI Badam 6. The 36 line ICGV 89259 showed the highest yield due to nut/plant and nut weight/plant.

### Farmers reaction

Farmer were very much encourage to see the performance of ICGV 89259 and BARI Badam 6. The experiment need to be repeated another year trial.

Table 1. Nut yield and yield contributing characters of groundnut conducted at Cox's Bazar in 2002-03

| Variety | Nut/plant (no.) | Nut weight/plant (g) | Nut yield (t/ha) |
|---|---|---|---|
| ICGV89259 | 41.67a | 64.53a | 2.61a |
| BARI Badam-6 | 36.77b | 60.67b | 2.41a |
| Dhaka-1 | 31.37c | 41.07c | 1.41b |
| Local | 27.53d | 39.87c | 1.19b |
| CV (%) | 7.5 | 6.7 | 7.6 |
| LSD (0.05) | 2.15 | 1.92 | 0.56 |

# DISSEMINATION OF NEWLY IMPROVED VARIETIES OF SWET POTATO


## Abstract

The experiment was conducted a farmer's field at Cox's Bazar during November 2002 to April 2003 to disseminate BARI released improved varieties by comparing with farmer's local. Tripti, Kamlasundari, Daulatpuri, BARI SP-5 sweet potato varieties were tested with farmers local. Significantly highest yield (23.4 t/h) was obtained from variety Kamlasundari but this variety did not like farmer due to less taste. In this case BARI SP-5 showed second highest yield but farmers prefer due to more taste.


## Introduction

BARI has released a number of sweet potato varieties. These varieties need to disseminate among the farmers at different location. Hence the proposed study was taken in hand to compare BARI released improved sweet potato varieties with farmer's local at Cox's Bazar in Chittagong region.

## Material and methods

The experiment was conducted at farmer's field at Cox's Bazar of Chittagong region during November 2002 to April 2003 to disseminate BARI released improved sweet potato varieties with farmer's local. Tripti, Kamlasundari, Daulatupuri and BARI SP-5 sweet potato varieties were tested with farmer's local. The experiment was conducted in a RCB design with five dispersed replications. The sweet potato varieties were planted at 26-28 November 2002 and harvested at 25-30 April 2003. The unit plot was $50m^2$ with spaced 60 x 30 cm. Urea, TSP and MP were applied at the rate of 160 g, 130 kg and 190 kg per hectare. Entire TSP and MP were applied during final land preparation. Half of urea was applied as basal and the rest half was applied at 60 days after planting. Data on number of tuber per plant, weight of tuber per plant and tuber yield on whole plot basis and analysed statistically. Farmers reactions also recorded.

## Result and Discussion

Yield and yield attributes of sweet potato varieties were presented in Table 1. Significantly the highest number of tuber per plant was obtained from Kamlasundari. Similar trend was followed in case of tuber weight/plant. Local variety showed lowest tuber weight/plant among the variety. Significantly the highest yield was recorded from Kamlasundari due to the highest no. of tuber/plant and weight of tuber/plant. Second highest yield was recorded from variety BARI SP-5 but statistically at par to local but farmer prefer BARI SP-5.

### Farmers reaction

Kamlasundari was less tasty, very clody after boiling. For this reason farmer did not like this type variety though highest yielder but farmers accepted BARI SP-5 due to more tasty. No major insect infestation and disease infection were found.

Table 1. Tuber yield and yield attributes of sweet potato varieties at Cox's Bazar in 2002-2003.

| Variety | Tuber/plant (no.) | Tuber weight/plant (kg) | Tuber yield (t/ha) |
|---|---|---|---|
| Tripti | 3.14 | 0.84 | 17.71 |
| Kamlasundari | 3.56 | 1.41 | 23.40 |
| Daulatpuri | 2.44 | 0.90 | 14.52 |
| BARI SP-5 | 3.04 | 1.03 | 19.21 |
| Farmer's local | 3.02 | 0.97 | 18.34 |
| CV(%) | 11.31 | 9.87 | 8.6 |
| LSD(0.05) | 0.41 | 0.42 | 2.14 |

# INTEGRATED FARMING

The subsistence farms of Bangladesh are highly diversified with complex relationships among the various sub-systems and the enterprises within a sub-system. While there are different production alternatives, farmers have a limited set of resources. These resources must be utilized in such a manner that maximizes farm productivity, farmer's benefit and resource use efficiency in an environmentally sound and sustainable way. A holistic approach to technology generation and packaging is essential to achieve this result through maximizing the complementary interactions among the different farming enterprises/ production system and the biophysical and socio-economic environment.

In this endeavor, an effort is being made to package the available proven technologies of the component sub-systems in whole farm perspectives to develop integrated farming system modules for different environment and clientele groups to improve whole farm system operation to maximize farm productivity, farmers' income and farm resource use efficiency as well as for eventual transfer of these modules to the target farmers since the last few years of BARI's FSRD program.

## Methodology

As the effort of packaging and testing technologies for developing integrated farming practices for highly complex and subsistence livelihood system in whole farm perspective is new, there is no recommended methodology for such studies. Accordingly, a 5-step new methodology being developed through an evolutionary process of trial and error using the experiences of FSRD practitioners of OFRD, BARI was adopted.

Step 1. Identification of proven/recommended technologies: A comprehensive list of all packages of recommended technologies of crops, livestock, fisheries and other components of the farming system for specific location/environment was prepared to help selection of appropriate technologies for intervention.

Step 2. Selection of farmer Cooperator: The cooperator farmers representing small and marginal farmers with farming as major profession, having major components of farming and sizable homestead under single ownership were selected at each site. The number of farmers selected at different sites ranged from two to more than 10.

Step 3. Accounting of pre-intervention status: The pre-intervention status of the selected farms was evaluated through case studies/surveys. In the process, the existing farm resources, assets, liabilities, present use of resources, existing farming practices and technologies used, level of input use and outputs obtained, performances of different enterprises, farm income and expenditure status, etc. was assessed for each farm.

Step 4. Analysis of existing system and selection of technologies for intervention: Based on the pre-intervention status, the system performance was analyzed in the context of existing biophysical and socio-economic environment of the farm and constraints and potentials were identified. To ensure maximum utilization of existing farm resources, alternate/new packages of technologies for different enterprises of all components of the farm were identified and finally selected on the basis of farmers' option. The number of new technologies/practices taken for intervention for different sub-systems varied from farm to farm depending on farmers' option and perceived potentials of the technologies. It may be mentioned that in the intervention plan, some of the farmer's earlier adopted practices were retained while some new practices replaced the traditional practices. To use the unexploited resources/opportunities, a large number of new practices were also included.

Step 5. Implementation of intervention and performance evaluation: After finalizing the proposed interventions, the farmers were motivated through all possible ways to utilize their own resources to adopt the interventions. However, in implementing some new technologies, a few critical inputs were provided free of cost and/or on credit. Throughout the entire period of implementation, regular technical support was provided on as and when necessary basis and the performance of different interventions were monitored regularly and necessary data were collected directly using standard methods.

During the reporting year, the study was continued for the $3^{rd}$-$4^{th}$ year with 12 farmers at Goyeshpur site, Pabna, four farmers at Narikeli site, Jamalpur, four farmers at Palima site, Tangail, three farmers at Lebukhali site, Patuakhali and one farmer at Golapganj site, Sylhet. While elaborate development program in integrated whole farm approach was undertaken involving scores of farmers at each of Syedpur site, Rangpur, Chobbishnagar site, Barind, Ishan Gopalpur site, Faridpur and Atkapalia site, Noakhali.

**Result and Discussion**

Twenty-five farms at in 9 FSRD sited have been intervened for a period of 1-3 years each. From each farm, a tremendous volume of data has been generated for both pre-intervention and intervention periods. Since each farm is unique in its own setting and resource use practices in both pre-intervention and intervention periods, it is virtually impossible, and perhaps, useless to attempt any systematic statistical analysis to compare the performance of different farms. Accordingly an attempt has been made to view each farm separately and system performance of pre-intervention and intervention periods have been compared to asses the impact of interventions on farm productivity, income and employment generation and other relevant parameters. In the following section, the result obtained at different sites will be presented.

The studies at all sites revealed that an individual farm consist of several resources like homestead, cropland, ponds, livestock, poultry and fisheries etc. Before intervention, these resources were not utilized properly for production purposes. But after proper motivation and introduction of several alternatives for each production units, the farmers adopted several new technologies according to their goals, preferences and availability of resources. The farm productivity, income, employment opportunity of the existing farming improved tremendously due to integration of technologies through holistic approach which led to improved livelihoods at all locations. The summary of findings at different sites is briefly presented below. From each farm, a tremendous volume of data has been generated for both pre-intervention and intervention periods. Since each farm is unique in its own setting and resource use practices in both pre-intervention and intervention periods, it is virtually impossible, and perhaps, useless to attempt any systematic statistical analysis to compare the performance of different farms. Accordingly an attempt has been made to view each farm separately and system performance of pre-intervention and intervention periods have been compared to asses the impact of interventions on farm productivity, income and employment generation and other relevant parameters. In the following section, the result obtained at different sites will be presented.

**Narikeli FSRD Site, Jamalpur**

Ten farmers, representing the marginal and small category were brought under whole farm intervention at the site during late nineties. However, the intervention continued with four farms during the reporting year due to funding constraints.

**Technologies/Practices used for Intervention**

As in other sites, a large number of recommended technologies for field crop production, homestead farming, livestock and fish production were included for intervening the farms (Table 1). However, depending on resources availability, the number of technologies adopted by a specific farm varied widely. The overall productivity of important technologies is presented in Table 2.

Table 1. List of interventions by sub-systems used in integrated farming studies at Narikeli site, Jamalpur

**Crop Subsystem**

1. T. Aman- BRRI Dhan 32 instead of Pajam
2. Wheat- Kanchan, Shourab, Ghourab instead of Sonalika
3. Mustard- BARI Sarisha-8, Tori-7 instead of local
4. Boro – BRRI Dhan-29, BRRI Dhan-28, BR-11 instead of local

**Homestead Subsystem**

1. White gourd on roof
2. Sweet gourd on roof
3. Bitter gourd on the fence
4. Sweet gourd on trail's
5. Indian spinach on trail's
6. Bottle gourd on pond trails (BARI Lau-1)
7. Mukhi kachu in partial shade area
8. Turmeric in partial shade area
9. Zinger in partial shade area
10. Kachu in waste land-(Latiraj)
11. Potato Yam on the Homestead trees (Ziga, Mandar, Drumstick,
12. Jujube, Betel nut, Coconut, mango and also on bamboo support)
13. BARI Shim-1, BARI Lau-1 on the trail's

***Homestead trees***

1. Mango hopper control, management and fertilization practices of different fruit trees
2. Fertilization and water management in Betel nut, Coconut, Guava and Jackfruit
3. Top working of Jujube
4. Mango hopper and parasite control
5. New plantation of mango (Khirshapati, Gopalbogh, Langra, Fazli, BARI mango-3, BARI mango-4), Litchi (China-3), Guava (BARI Guava-1 and 2), Sofeda, Seedless Lemon, Drumstick, Coconut, Betel nut, Kamranga, Neem, Papaya, Pome granite, Amra, Amloki, Sarifa, Tissue cultured jackfruit and banana, Mahogany

**Livestock Subsystem**

1. Deworming of cattle
2. Vaccination of poultry
3. Rearing of poultry (broiler and layer)
4. Introduction of goat

## Adoption of Technologies

All the farms adopted quite a large number of technologies. A list of the technologies used during intervention and pre-intervention periods is shown in table 2.

Table 2: Technologies used during the pre-intervention and intervention periods in different subsystems at FSRD Site, Narikeli, Jamalpur

| Resource | Pre-intervention period | During intervention period |
|---|---|---|
| **A. Homestead** | | |
| Open land | Bottle gourd, Country bean (Local) | Tomato, Cauliflower, BARI Dherosh 1, Lalshak, Carrot, BARI Lau 1, BARI Shim 1, Data, Spinach, Onion, Garlic, Green piper, White gourd, Sweet gourd |
| Roofs | None | Potato Yam, BARI Shim 1 , BARI Lau 1 |
| Trellis | Bottle gourd, Country bean (Local) | Potato Yam, BARI Shim 1, BARI Lou 1, Betel vine |
| Creeper vegetable on tree support | None | Potato yam, Betel vine |
| Fence | Not used | Bitter gourd, Potato Yam, Rib gourd, Cucumber |
| House boundary | Betel nut, Coconut, Banana, Drumstick | Mango (Amrapali, Khirshapati, Gopal bogh, Langra, Fazli, BARI mango-3, BARI mango-4), Litchi (China-3), Guava (BARI Guava-1 and 2), Safeda, Seedless Lemon, Kamranga, Neem, Orboroi, Papaya, Dalim, Amra, Sarifa, Mahoginy |
| Tree improvement | None | Coconut & betel nut management, Jujube budding, Hopper and parasite control of mango, |
| **B. Fishery system** | | |
| Backyard ditch | Not used | Seasonal fish culture |
| Perennial pond | Cattla, Roi, Mrigel | Grass carp, Sharpunti, Silver carp, Katla, Roi, Mrigel |
| **C. Livestock** | Cow (Local), Poultry (Local) | Poultry (Foumi, Sonali, Hisex brown) |
| Cooking | Traditional Chula | BARI Chula |
| Sanitation and health | Traditional latrine | Sanitary latrine, cleaning the homestead area |

**Farm Productivity and Income**

The overall productivity of technologies used for intervention was much higher than the conventional practices of the farmers (Table 3). There was a tremendous impact of the interventions on the diversification and increase production of commodities in all the four farms intervened due to both horizontal and vertical increase in production due to adoption of improved technologies and addition new production enterprises (Tables 4-7).

Table 3. Productivity of different technologies before and after intervention at FSRD site, Narikeli, Jamalpur

| Resource | Before intervention | | After intervention | | Remarks |
|---|---|---|---|---|---|
| | Variety/item | Yield (t/ha) | Variety/item | Yield (t/ha) | |
| T.Aman | Pajam | 2.44 | BRRI Dhan 32, BRRI Dhan 33 | 4.52, 4.12 | |
| Boro | BR 14 | 3.95 | BR 28, 29 | 4.30, 6.00 | |
| Jute | Local | 1.29 | O-9897 | 2.59 | |
| Homestead | White gourd<br>Bottle gourd<br>Sweet gourd<br>-<br>-<br>-<br>- | 19 N<br>16 N<br>12 N<br>-<br>-<br>-<br>- | Local<br>BARI Lau-1<br>Snake gourd<br>Pointed gourd<br>Cucumber<br>Bitter gourd<br>Indian spinach | 28 N/pit<br>51 N/pit<br>16 kg/pit<br>18 kg/pit<br>16 kg/pit<br>15 kg/pit<br>21 kg/pit | Proper nutrient and management |
| Partial shady area | -<br>-<br>-<br>- | -<br>-<br>-<br>- | Turmeric<br>Zinger<br>Mukhi kachu<br>Elephant Taros | 16 kg/dec<br>17 kg/dec<br>21 kg/dec<br>22 kg/dec | |
| Trellis | -<br>- | -<br>- | Potato yam<br>BARI Shim-1 | 12 kg/pit<br>10 kg/pit | |
| Ponds surroundings | -<br>- | -<br>- | White gourd<br>Bottle gourd | 20 N<br>40 N | |
| Livestock | Ox (Trad) | 40 kg/ox | Ox (imprv) | 80 kg | Meat/ox/year |
| | Local hen | 33 N egg | Exotic | 200 N egg | N/hen/year |
| Fisheries | Pond (Trad) | 18 kg | Mixed culture | 40 kg | 3 dec/year |

Table 4. Details of farm productivity and returns by intervention of integrated farming (Farmer 1: Md. Abdul Khaleque) at FSRD site, Narikeli, Jamalpur.

A. Crop

| Resource | Area | Before intervention | | | | After intervention | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pattern | Prod. (kg) | TVC | GM | Pattern used | Prod. (kg) | TVC | GM | Increase net return |
| MHL-1 | 26 d | Aman (Pajam)<br>Boro (BR 14) | 220<br>300 | 800<br>1300 | 1000<br>700 | Aman (BR 32)<br>Boro (BR 28) | 350<br>400 | 1400<br>2000 | 1025<br>1175 | |
| Sub-Total | | | | 2100 | 1700 | | | 3400 | 2200 | 500 |

B. Homestead

| Resource | Area | Before intervention | | | | After intervention | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Practice used | Prod. (kg) | TVC (Tk) | GM (Tk) | Practice used | Prod. (kg) | TVC (Tk) | GM (Tk) | Increa se net return |
| Roof | 2 d | White gourd | 35 N | 60 | 200 | Sweet gourd<br>White gourd | 25 N<br>50 N | 115 | 495 | |
| Trail | 1 d | Bottle gourd<br>Sweet gourd | 17 N<br>12 N | 120 | 116 | Snake gourd<br>Pointed gourd<br>Cucumber<br>Bitter gourd | 12<br>18<br>16<br>15 | 205 | 255 | |
| Open field | 4 d | Not cultivation | - | - | - | Homestead model | 90 | 195 | 410 | |
| Partial shade area | 2 d | Not cultivation | - | - | - | Turmeric<br>Ginger<br>Mukhi khakhu | 26<br>3<br>7 | 135 | 350 | |
| Waste land | 2 d | Not cultivation | - | - | - | Kachu (Latijaj) | 52 | 175 | 350 | |
| On support | 1 d | Not used | - | - | - | Potato yam<br>BARI shim | 35<br>29 | 175 | 400 | |
| Sub. Total | 12 d | - | - | 180 | 316 | | | 1000 | 2260 | 1944 |

C. Livestock

| Resource | Before intervention | | | | | After intervention | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | Practiced | Prod. (kg) | TVC (Tk) | GM (Tk) | No. | Practiced | Prod. (kg) | TVC (Tk) | Increase net return |
| Hen (L)<br>Hen (Improve) | 6N<br>- | No Vaccination<br>- | Egg 153 N<br>- | 215<br>- | 166<br>- | -<br>10 N | -<br>Vaccination and feeding | <br>1500 | -<br>2000 | |
| Ox | 1 | Normal feeding | Meat 48 kg | 2185 | 989 | | Dewarming UMS diet | Meat 82 kg | 3000 | |
| Sub-Total | | | | 2400 | 1155 | | | | 5000 | 4345 |

Table 5. Details of farm productivity and returns by intervention of integrated farming (Farmer 2: Ranju Fakir) at FSRD site, Narikeli, Jamalpur.

A. Crop

| Resource | Area | Before intervention | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pattern used | Prod. (kg) | GR | TVC | GM | Pattern used | Prod. (kg) | GR | TVC | GM | Increase net return |
| MHL-1 | 13 d | Aman (Pajam)<br>Boro (BR 14) | 125<br>170 | 1120<br>1190 | 550<br>600 | 570<br>590 | Aman (BR 32)<br>Boro (BR 29) | 210<br>280 | 1560<br>1960 | 650<br>900 | 910<br>1060 | |
| Sub-Total | | | | 2310 | 1150 | 1160 | | | 3520 | 1550 | 1970 | 810 |

B. Homestead

| Resource | Area | Before intervention (99-2000) | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practice used | Prod. (kg) | TR (Tk) | TVC (Tk) | GM (Tk) | Practice used | Prod. (kg) | TR (Tk) | TVC (Tk) | GM (Tk) | Increase net return |
| Roof | 2 d | White gourd | 20N | 160 | 45 | 115 | Sweet gourd<br>White gourd | 23 N<br>34 N | 665 | 260 | 405 | |
| Trellis | 1 d | Bottle gourd | 8 N | 65 | 30 | 35 | Snake gourd<br>Sweet gourd<br>Pointed gourd<br>Cucumber | 18<br>13<br>17<br>18 | 620 | 185 | 435 | |
| Open field | 5 d | Not cultivation | - | - | - | - | Homestead model | 95 | 760 | 290 | 470 | |
| Partial shade area | 1 d | Not cultivation | - | - | - | - | Turmeric<br>Ginger<br>Elephant taro | 12<br>3<br>25 | 705 | 270 | 435 | |
| On support | 2 d | Not used | - | - | - | - | Potato yam<br>BARI shim | 90<br>60 | 1350 | 195 | 1155 | |
| Sub. Total | 11 d | - | - | 225 | 75 | 150 | | | 4100 | 1200 | 2900 | 2750 |

C. Livestock

| Resource | No | Before intervention | | | | | No | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Increase net return |
| Hen (L) | 6 | No Vaccination | Egg 185 | 536 | 220 | 316 | 10 | Vaccination and feeding | Egg 1500 | 4350 | 1660 | 2690 | |
| Ox | 1 | Normal feeding | Meat 38 kg | 2714 | 1960 | 754 | 1 N | Dewarming UMS diet | Meat 82 kg | 8050 | 5340 | 2710 | |
| Sub-Total | | | | 3250 | 2180 | 1070 | | | | 12400 | 7000 | 5400 | 4330 |
| Off-Farm activities | | - | | 1000 | 400 | 600 | | - | - | 1600 | 500 | 1100 | 500 |

Table 6 Details of farm productivity and returns by intervention of integrated farming Farmer 3: Md. Shamsul Haque Akanda) at FSRD site, Narikeli, Jamalpur.

A. Crop

| Resource | Area | Before intervention | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pattern used | Prod. (kg) | GR | TVC | GM | Pattern used | Prod. (kg) | GR | TVC | GM | Increase net return |
| MHL-1 | 26 d | Aman (Pajam)<br>Boro (BR 14) | 250<br>320 | 2000<br>2240 | 800<br>1100 | 1200<br>1140 | Aman (BR 32)<br>Boro (BR 28) | 350<br>350 | 2800<br>2450 | 1200<br>1425 | 1600<br>1025 | |
| Total | | | | 4240 | 1900 | 2340 | | | 5250 | 2625 | 2625 | |
| MHL-2 | 26 d | Aman (BR 11)<br>Boro (BR 14) | 350<br>390 | 2450<br>2750 | 1250<br>1150 | 1200<br>1600 | Aman (BR 32)<br>Boro (BR 29) | 340<br>370 | 2720<br>2580 | 1225<br>1400 | 1495<br>1180 | |
| Total | | | | 9440 | 4300 | 5140 | | | 10550 | 5250 | 5300 | 160 |

B. Homestead

| Resource | Area | Before intervention | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practice used | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Practice used | Prod. (kg) | TR (Tk) | TVC (Tk) | GM (Tk) | Increase net return |
| Roof | 4 d | White gourd | 45 | 360 | 90 | 270 | Sweet gourd<br>White gourd | 42<br>65 | 825 | 450 | 375 | |
| Trellis | 2 d | Bottle gourd<br>Sweet gourd | 30<br>15 | 240 | 80 | 160 | Snake gourd<br>Pointed gourd<br>Cucumber<br>Bitter gourd | 32<br>29<br>44<br>14 | 850 | 460 | 390 | |
| Open field | 6 d | Not cultivation | - | - | - | - | Homestead model | 200 | 1600 | 450 | 1150 | |
| Partial shade area | 4 d | Not cultivation | - | - | - | - | Turmeric<br>Ginger<br>Elephant taro | 35<br>4<br>30 | 845 | 340 | 505 | |
| Waste land | 4d | Not cultivation | - | - | - | - | Kachu s(latiraj) | 115 | 675 | 180 | 495 | |
| Ponds surrounding | 2 d | Not used | - | - | - | - | White gourd<br>Bottle gourd<br>BARI Shim-1 | 32<br>38<br>20 | 745 | 600 | 145 | |
| On support | 4 d | Not used | - | - | - | - | Potato yam<br>BARI Shim-1 | 35<br>35 | 670 | 520 | 150 | |
| Sub. Total | 44 d | - | - | 600 | 170 | 430 | | | 6210 | 3000 | 3210 | 2780 |

C. Livestock

| Resource | No | Before intervention | | | | | No | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Increase net return |
| Hen (L)<br>Hen (Improve) | 5<br>- | No Vaccination<br>- | Egg 200<br>- | 580<br>- | 250<br>- | 330<br>- | 2<br>5 | Vaccination<br>Vaccination and feeding | Egg 100<br>Egg 600 | 290<br>1740 | 150<br>450 | 140<br>1290 | |
| Duck (L) | 4 | No vaccination | Egg 140 | 350 | 280 | 70 | 4 N | Vaccination and feeding | Egg 225 | 562 | 320 | 242 | |
| Ox | 2 | No UMS diet | Meat 95 kg | 6150 | 3810 | 2340 | 2 N | Dewarming UMS diet | Meat 137 kg | 8918 | 2600 | 6318 | |
| Sub-Total | | | | 7080 | 4340 | 2740 | | | | 11510 | 3520 | 7990 | 5250 |
| Pond | 6 d | Traditional | 35 kg | 1500 | 800 | 700 | 6 d | Mixed culture | 75 kg | 3000 | 850 | 2150 | 1450 |

Table 7. Details of farm productivity and returns by intervention of integrated farming (Farmer 4. Md. Abu Taleb) at FSRD site, Narikeli, Jamalpur.

A. Crop

| Resource | Area | Before intervention | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pattern used | Prod. (kg/plot) | GR | TVC | GM | Pattern used | Prod. (kg) | GR | TVC | GM | Increase net return |
| MHL-1 | 45d | Aman (Pajam)<br>Jute (local) | 310<br>275 | 2480<br>2765 | 1050<br>1250 | 1430<br>1515 | Aman (BR 32)<br>Boro (BR 28) | 326<br>345 | 2280<br>2415 | 960<br>1110 | 1320<br>1305 | |
| MHL-2 | 50d | Aman (Pajam)<br>Boro (BR 14) | 315<br>385 | 2520<br>2695 | 1100<br>1400 | 1420<br>1295 | Aman (BR 32)<br>Boro (BR 28) | 345<br>350 | 2415<br>2450 | 980<br>1100 | 1435<br>1350 | |
| Sub-Total | | | | 10460 | 4800 | 5660 | | | 9560 | 4150 | 5410 | -250 |

B Homestead

| Resource | Area | Before intervention | | | | | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practice used | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Practice used | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Increase net retur |
| Roof | 2 d | White gourd | 16 | 100 | 32 | 68 | Sweet gourd<br>White gourd | 22 N<br>40 N | 696 | 165 | 531 | |
| Trellis | 1 d | Bottle gourd<br>Sweet gourd | 26<br>10 | 165 | 90 | 75 | Snake gourd<br>Pointed gourd<br>Cucumber<br>Bitter gourd<br>Indian spinach | 26<br>21<br>28<br>18<br>26 | 1300 | 860 | 440 | |
| Open field | 2 d | Not cultivated | - | - | - | - | Homestead model | 70 | 660 | 180 | 480 | |
| Partial shade area | 1 d | Not cultivated | - | - | - | - | Turmeric<br>Ginger<br>Mukhi khakhu<br>Elephant font | 20<br>4<br>21<br>30 | 780 | 360 | 420 | |
| Ponds surroundings | 1 d | Not used | - | - | - | - | White gourd<br>Bottle gourd | 25<br>40 N | 550 | 320 | 230 | |
| On support | 1 d | Not used | - | - | - | - | Potato yam<br>BARI shim | 45<br>35 | 1234 | 345 | 889 | |
| Sub. Total | 8 d | - | - | 265 | 122 | 143 | | | 5220 | 2230 | 2990 | 2847 |

C. Livestock and Fishery

| Resource | No | Before intervention | | | | | No | After intervention | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | | Practiced | Prod. (kg) | GR (Tk) | TVC (Tk) | GM (Tk) | Increase net return |
| Hen (L) | 4 | No Vaccination | Egg 160 | 464 | 200 | 264 | 2 | Vaccination | Egg 140 | 406 | 220 | 186 | |
| Hen (Improve) | | - | - | - | - | - | 8 | Vaccination and feeding | Egg 1200 | 3480 | 500 | 2980 | |
| Ox | 1 | Normal feeding | Meat 40 | 2633 | 1920 | 713 | 1 | Dewarming UMS diet | Meat 85 kg | 5344 | 2430 | 2914 | |
| Sub-total | | | | 3097 | 2120 | 977 | | | | 9230 | 3150 | 6080 | 5103 |
| Pond | 3 d | Traditional practice | 8 | 400 | 310 | 90 | 3 d | Mixed culture | 80 | 4000 | 500 | 3500 | 3410 |
| Off-farm activities | 1 N | - | - | 2000 | 500 | 1500 | 1N | - | - | 3000 | 1000 | 2000 | 500 |

The overall farm income in every subsystem increased remarkably. The combined net benefit increaseper farm ranged from 99-253% (Table 8).

Table 8. Cost and returns from different subsystems of integrated farming of medium farms at FSRD site Narikeli, Jamalpur

| Farmer | Resource | Before intervention | | | After intervention | | | Increase net return |
|---|---|---|---|---|---|---|---|---|
| | | GM (Tk) | TVC (Tk) | Net return (Tk) | GM (Tk) | TVC (Tk) | Net return (Tk) | |
| Abdul Khaleque | Crop | 3800 | 2100 | 1700 | 5600 | 3400 | 2200 | 500 |
| | Homestead | 496 | 180 | 316 | 3260 | 1000 | 2260 | 1944 |
| | Livestock | 3555 | 2400 | 1155 | 10500 | 5000 | 5500 | 4345 |
| | **Total** | **7851** | 4680 | 3171 | 19360 | 9400 | 9960 | **6789 (214%)** |
| Ranju Fakir | Crop | 2310 | 1150 | 1160 | 3520 | 1550 | 1970 | 810 |
| | Homestead | 225 | 75 | 150 | 4100 | 1200 | 2900 | 2750 |
| | Livestock | 325 | 2180 | 1070 | 12400 | 7000 | 5400 | 4330 |
| | Off-farm activities | 1000 | 400 | 600 | 1600 | 500 | 1100 | 500 |
| | **Total** | **6740** | 3805 | 2935 | 21620 | 10250 | 10370 | **7435 (253%)** |
| Shamsul Haque Akanda | Crop | 9440 | 4300 | 5140 | 10550 | 5250 | 5300 | 160 |
| | Homestead | 600 | 170 | 430 | 6210 | 3000 | 3210 | 2780 |
| | Livestock | 7080 | 4340 | 2740 | 11510 | 3520 | 7990 | 5250 |
| | Fisheries | 1500 | 800 | 700 | 3000 | 850 | 2150 | 1450 |
| | **Total** | **18620** | 10620 | 8000 | 28570 | 12620 | 15950 | **7950 (99%)** |
| Abu Taleb | Crop | 10460 | 4800 | 5660 | 9560 | 4150 | 5410 | -250 |
| | Homestead | 265 | 122 | 143 | 5220 | 2230 | 2990 | 2847 |
| | Livestock | 3097 | 2120 | 977 | 9230 | 3150 | 6080 | 5103 |
| | Fisheries | 400 | 310 | 90 | 4000 | 500 | 3500 | 3410 |
| | Off-farm activities | 2000 | 500 | 1500 | 3000 | 1000 | 4000 | 2500 |
| | **Total** | **16222** | 7852 | 8370 | 31010 | 11030 | 19980 | **11610 (138%)** |

**Impacts on labour utilization and family welfare**

Use of family labour increased (women 75%, children 10% and male labour 15%) increased due to huge intervention of technologies in integrated farming. More participation of women in agricultural activitiesmade positive impact on gender equity issues within the family and the community as a whole. It was observed that increased farm production and income together with motivation with new knowledge and skills improved the livelihood in all the farms intervened.

Table 9. Impacts of integrated farming intervention on the improvement of the livelihood systems at FSRD sire, Narikeli, Jamalpur

| Name | Assets developed | Living standard | | | | Children education | Savings |
|---|---|---|---|---|---|---|---|
| | | Food | Living condition | Sanitation | Medicare | | |
| Md. Abdul Khaleque | Buying of 2 calves, improvement of kitchen room by fencing, roof with tin and earth working | Better intake of vegetables | Increase social acceptance | Use of hygienic sanitary latrine | Better health care | Daughter- Married<br>Son- Married (Service)<br>Son- Class IX<br>Daughter- Baby | Loan repaying |
| Md. Ranju Fakir | Improvement of kitchen, development of homestead area by earth working | Better intake of vegetable, fishes, egg and fruits | Increase social status due to economic upliftment | Use of hygienic sanitary latrine | Better health care | Daughter KG - I<br>Son- Baby | Loan repaying |
| Md. Shamsul Haque Akanda | Improvement of residence by tin in lieu of thatching material | Intake of vegetable, fruits, milk, meat and egg | Better social acceptance | Use of sanitary latrine | More conscious about health care | Daughter- Married<br>Son- Agriculture | Savings in Bank |
| Abu Taleb | Improvement of dwelling house by tin replacing thatched house, buying of new land | Better intake of vegetable, fish, egg fruits | Increasing social status due to economic upliftment | Use of hygienic sanitary latrine | Better health care | Daughter- KG I<br>Son- Baby | Loan repaying |

**Goyeshpur FSRD Site, Pabna**

Twelve farms, four from each of marginal, small and medium category were intervened under integrated farming study at Goyeshpur FSRD site, Pabna during 2002-03 with a view to maximize the utilization of all available farm resources, farm productivity and income. The results of intervention with improved technologies/practices as compared to the pre-intervention period is presented below:

***Use of technologies/improved practices***

The number of improved technologies/practices used to replace the old practices and introduce new enterprises varied greatly among and within the farm categories. The specific technologies adopted by a farm depended on the farmers' preferences and availability of resources. Thus the number of technologies adopted by different farms varied. A comprehensive list of the technologies used is presented in Table 1.

**Table 1: Improved/ recommended technologies used for integrated farming systems at FSRD Site, Goyeshpur, Pabna**

| Resources | | | Technologies for intervention |
|---|---|---|---|
| **A. Homestead: New year round vegetable model** | | | |
| Open land | Bed 1 | : | Radish (Tasaki)-Stem amaranth (LIV)- Indian spinach |
| | Bed 2 | : | Cabbage (Atlas 70) - Brinjal – Red amaranth |
| | Bed 3 | : | Tomato (Raton) + Spinach – Okra (BARI Dheros 1) |
| Roofs | | : | Bottle gourd (BARI Lau 1) – White gourd |
| Trellis | | : | Bottle gourd (BARI Lau 1) – Sweet gourd |
| Trees (fruitless) | | : | Potato yam/Country bean/Sponge gourd |
| Partially shady area | | : | Elephant foot yam, Leaf aroid, Ginger |
| Marshy land | | : | Water taro |
| Fence | | : | Bitter gourd, Yard long bean |
| House boundary | | : | Papaya, Lemon, Guava |
| Back yard | | : | Laizna, Plantain banana |
| **Other development activities of the homestead**: | | | |
| Existing trees | | : | Manuring, fertilization, pest control, irrigation, drainage, top working of fruit and forest species. |
| New plantation of HY varieties | | : | Mango, Litchi, Pumelo |
| Grafting nursery for HYV fruit trees | | : | Grafting of mango/Litchi/Jujube seedling |
| Environment friendly cooking oven | | : | BARI cooking oven |
| Use of organic wastes for cooking, lighting and use as fertilizer | | : | i. Biogas plant with cattle/poultry excreta<br>ii. Composting with house waste |
| Seed preservation | | : | Using scientific method for seed preservation |

| | |
|---|---|
| **B. Pond (perennial & seasonal)** | ⇨ Polyculture of Pangas and crap fish |
| | ⇨ Monoculture of Pangas |
| | ⇨ Integrated poultry/duck-cum-fish + vegetables production |
| | ⇨ Polyculture of carp fish |
| | ⇨ GIF Tilapia in ditch or seasonal pond |
| | ⇨ Fingerling production of different fish species |
| **C. Livestock:** | ⇨ Broiler production |
| | ⇨ Bull fattening |
| | ⇨ Milking cow rearing |
| | ⇨ Pigeon rearing |
| | ⇨ Layer (HYV) rearing (Improved breed) |
| | ⇨ Goat rearing |

**D. Crop land:**

| Resources | | Technologies for intervention |
|---|---|---|
| i. High land | : | Carrot (Hybrid new coruda) - Sesame (HYV) - T.Aman (BRRIDhan32) |
| | | Bulb Onion (HYV) - Mungbean (HYV) - T.Aman (BRRIDhan31) |
| | | Papaya (LIV) - (Two year cycle) |
| | | Mustard (BARI-8) - Mungbean (BINA 5) - T.Aman (BRRIDhan33) |
| | | Lentil (BARI-4) - Jute (O-9897) - T.Aman (BRRIDhan31) |
| | | Cauliflower (White contesa) - Sweet gourd - Red amaranth |
| | | Cabbage (Atlas 70) - Lady's finger (BARI-1) - Red amaranth |
| | | Tomato (Raton) - Bitter gourd (LIV) - Red amaranth |
| | | Spinach (Kupi) - White gourd (IPSA) - Red amaranth |
| | | Bottle gourd (BARI 1) Bitter gourd (LIV) - with or without trellis |
| ii. Medium high land | : | Wheat - GM - T.Aman (BRRIDhan31) |
| | | Maize (Hybrid) - GM - T.Aman (BRRIDhan32) |
| | | Mustard (BARI-8) - Jute (O-9897) - T.Aman (BRRIDhan31) |
| | | Onion (BARI 1) - Sesame (T6) - T.Aman (BRRIDhan31) |
| | | Grass pea - Jute (O-9897) - T.Aman (BRRIDhan32) |
| iii. Medium lowland | : | Boro (BRRIDhan29) - Fallow - - T.Aman (BR11) |
| | | Boro (BRRIDhan29) - Fallow - T.Aman (BRRIDhan31) |

### *Farm Resource Utilization*

During the pre-intervention period, most of the farms had serious underutilization of available resources for productive/income generating purposes. But during the intervention period the farmers introduced several alternatives practices and new enterprises in almost all farming subsystems. This led to full utilization of both physical and other farm resources available in the disposal of the farm and mobilized resources for food security, income generation and improvement of livelihoods.

***Farm Productivity***

Farm productivity increased due to increase of yield per unit area as well as addition of new/ alternative enterprises. In the first place, the crop yields increased due to adoption of recommended technologies and better use of farm resources. Secondly, addition of new enterprises added new commodities. However, considering the volume the data of individual farm, they are not included here.

***Farm income***

Farm income increased remarkably with whole farm intervention and the income varied widely with different farm categories. In marginal farms, the mean gross margin from homestead, crop, livestock and fisheries increased by 68.0, 115.4, 707.6 and 81.7 percent respectively. The business enterprises, however, showed a negative growth by 61.5 percent (Table-2). The overall increase of gross margin of the farm other than business was **??** percent over pre-intervention period.

In case of small farms, the increased gross margins in respective subsystems were 44.1, -40.4, 86.3 and 431.1 percent. The business ventures in this farm category, however, showed an increases gross margin of 139 and the overall increase was 25.6 percent, respectively. As compared to pre-intervention period (Table-3). The highest net benefit was obtained from fisheries subsystem, probably due to introduction of improved pond fishery technologies and bringing both ponds and backyard ditches in production.

Table 2. Per farm cost and gross margin from different subsystems of integrated farming by marginal farm category at FSRD site Goyeshpur, Pabna 2002-03

| Subsystems | Before intervention | | After intervention | | % Increase |
|---|---|---|---|---|---|
| | TVC (Tk/farm) | GM (Tk/farm) | TVC (Tk/farm) | GM (Tk/farm) | |
| Homestead | 431 | 3916 | 714 | 6588 | 68.0 |
| Crop | 9191 | 4763 | 7541 | 10259 | 115.4 |
| Livestock | 1680 | 1238 | 12682 | 9998 | 707.6 |
| Fisheries | 2430 | 2370 | 1040 | 4307 | 81.7 |
| Business | 31460 | 29217 | 28048 | 11238 | -61.5 |
| Total | 45192 | 41504 | 50025 | 42390 | 2.13 |

Table 3. Per farm cost and gross margin from different subsystems of integrated farming by small farm category at FSRD site Goyeshpur, Pabna 2002-03

| Subsystems | Before intervention | | After intervention | | % Increase |
|---|---|---|---|---|---|
| | TVC (Tk/farm) | GM (Tk/farm) | TVC (Tk/farm) | GM (Tk/farm) | |
| Homestead | 340 | 2376 | 207 | 3425 | 44.14 |
| Crop | 13579 | 29552 | 7866 | 17611 | -40.41 |
| Livestock | 1330 | 3228 | 982 | 6014 | 86.30 |
| Fisheries | 650 | 2312 | 605 | 12280 | 431.14 |
| Business | 1300 | 6800 | 18750 | 16250 | 138.97 |
| Total | 17199 | 44268 | 28410 | 55580 | 25.55 |

In case of medium farms the homestead sector showed slight increase in gross margin (10%) while both crop and business subsystems showed negative effect. The livestock and fisheries sectors showed increase of gross margins by 357.8 and 138.6 percent, respectively. Due to negative returns in crop and business sectors, the overall gross margin was reduced to only 7.78 percent in this farm category.

Table 4. Per farm cost and gross margin from different subsystems of integrated farming by medium farm category at FSRD site Goyeshpur, Pabna 2002-03

| Subsystems | Before intervention | | After intervention | | % Increase |
|---|---|---|---|---|---|
| | TVC (Tk/farm) | GM (Tk/farm) | TVC (Tk/farm) | GM (Tk/farm) | |
| Homestead | 202 | 3643 | 346 | 4009 | 10.00 |
| Crop | 32138 | 40197 | 19215 | 38493 | -4.24 |
| Livestock | 1195 | 3303 | 4829 | 15121 | 357.80 |
| Fisheries | 831 | 2550 | 4950 | 6084 | 138.59 |
| Business | 12760 | 10600 | 250 | 1275 | -87.97 |
| Total | 47126 | 60293 | 29590 | 64982 | 7.78 |

### *Family Labour Utilization*

Utilization of surplus family (viz. women, children) and hired labor increased due to huge intervention of technologies in integrated farming. The higher participation of women in agricultural activities made positive impact on equity issues within the family and the community as a whole.

### *Changes in Food habit and food security*

During the pre-intervention period, the farmers consumed much less amount of vegetables, fruits and animal protein as compared to post-intervention period. Introduction of the newly developed year round vegetable production model, raring of layer and broiler chickens, fish polyculture in seasonal and perennial ponds and ditches, etc. ensured availability of and consumption of balanced and nutritious food to all members of the households. The per day vegetable production averaged 1.57 kg/farm with the new model, which can fulfill the requirement of five member farm family.

### *Impacts*

The following general impacts were observed after intervention of technologies through holistic approach in integrated farming:

1. In integrated farming system (IFS) farmers are preserved the kitchen waste, manures, crop residues, animal waste, poultry litter, cowdung at their farm level scientifically and using properly for crop production, which ultimately helped to improve soil fertility and moisture conservation, thereby reducing environmental pollution in order to get sustainable agricultural production.
2. Through holistic approach each and every production unit was effectively utilized for generating more cash income.
3. Unlike traditional practices of agriculture activity where the cash is expected only at the time of disposal of the output, the integrated farming provides flow of cash to the farmers round the year from different enterprises like egg, milk, meat, vegetables, fish, fruits etc.
4. Timely application of recommended seeds, fertilizers and plant protection measure in holistic approach helped to boost production. The same technology was rapidly disseminated to many farmers around the program.
5. The holistic farm approach directly and indirectly changed in food habit, nutritional status, health care, clothing and sanitation, saving pattern and borrowing of the practicing farmers.
6. Integration of crop enterprise with livestock and fisheries got advantage of complementary and supplementary relationship among them, which have created more employment opportunity and better utilization of resources.
7. Integrated farm units were used as centers of agricultural development in the local area, where neighbor and other farmers and visitors are acquiring new technical know how leading to quickly dissemination of farm innovations.

**Golapganj, Sylhet**

Three farms were intervened for consecutive four years till 2001-02. However, due to discontinuation of funding support, the intervention continued with only one farm in 2002-03. The family profile and the account of farm resources are given in Table 1 and 2.

Table 1. The family profile of the farmer

| Type | Occupation | Education | Male | female | Total |
|---|---|---|---|---|---|
| Children (<15 yrs) | St. | School going | 3 | 1 | 4 |
| Adult (15-60 yrs) | H/w, Ag, St | II-XII | 4 | 4 | 8 |
| Old (above 60 yrs) | - | VII | 1 | 1 | 2 |
| Total | | | 8 | 6 | 14 |

* H/w- House wife, Ag-Agriculture, St-Student

Table 2. Land resources of the farmer (dec):

| Land Type | 1997-98 | 1998-99 | 1999-2000 | 2000-01 | 2001-02 | 2002-03 |
|---|---|---|---|---|---|---|
| Cultivable | 8+21* | 8+21* | 8+101* | 8+171* | 8+171* | 23+170* |
| Homestead | 22 | 22 | 29.5 | 29.5 | 29.5 | 40 |
| Ponds and ditches | 27 | 27 | 27+20* | 27 | 27 | 27 |
| Open land | 2 | 2 | 2 | 2 | 2 | 2 |
| Waste land | 27 | 27 | 27 | 27 | 27 | 16.5 |
| Total | 86+21* | 86+21* | 66.5+121* | 93.5+171* | 93.5+171* | 108.5+170* |

*Area under lease

The farmer has bought 7.5 and 15 decimal of land in 1999-2000 and 2002-03. He has also developed 10.5 decimal wasteland for cultivation adjacent to homestead area in 2002-03.

**Technologies for Intervention**

A good number of proven technologies were used to intervene the farm resource base covering all major subsystems as shown in Table 3.

Table 3. List of interventions in different subsystem of the farmer:

| Subsystem | Interventions |
|---|---|
| A. Crop sector | i) T. Aus – BR 26 |
| | ii) T. Aman - BRRI Dhan 32 |
| | iii) Tomato - Manik, Ratan, BARI Tomato-6,8,12 |
| | iv) Onion - Tahirpuri |
| | v) Cabbage - Atlas-70 |
| | vi) Boro - BINA-6, BRRI Dhan-29 |
| | vii) Mustard - Improved Tori-7, BARI Sarisha-9 |
| | viii) Khira and Sweet gourd - using bait trap for controlling fruit fly. |
| | ix) Chickpea- Annigeri, BARI Chola-2,3 |
| B. Homestead sector | i) Country bean – intercropped with mukhikachu and turmeric. |
| | ii) Vegetable seedling raising technology |
| | iii) Sapling of different fruits |
| | iv) Mukhikachu - Bilashi |
| | v) Bottle gourd – BARI Lau-1 |
| | vi) Guava - Kazi piara, BARI Piara-1 |
| | vii) Lemon - Seedless |
| | viii) Potato yam- on existing trees. |
| | ix) Tomato - Manik, Ratan, BARI Tomato-6,8,12 |
| | x) Panikachu - Latiraj |
| | xi) Ribbed gourd |
| | xii) Okra – BARI Dherosh-1 |
| | xiii) Honey bee rearing |
| | xiv) Top working of jujube |
| | xv) Fertilization of existing fruit trees |
| C. Livestock | i) Fayoumi rearing |
| | ii) Vaccination of poultry |
| D. Fisheries | i) Mixed polyculture |

***Productivity of different commodities before and after intervention***

The productivity of different commodities before intervention was very low as compared to that of intervention period. Intervention with new/improved technologies and putting all available resources in production of additional commodities, the yield and production of all commodities increased tremendously (Table 4). The gross margin of almost all intervention/enterprises increased tremendously with resultant increase in the MBCR. The overall economic impact of four years (98-99 to 02-03) of integrated farming is shown in Table 5. Before intervention the farmer obtained a gross margin of Tk. 15744 with Tk. 2514, 11430, 600 & 1200 respectively from crop, homestead, livestock and fisheries sub systems. The total variables cost at before intervention was Tk 7567. But

after intervention, the gross margin increased up to 529% (average of five years) and their sectorial contribution were Tk. 41452, 39345, 3868 and 14310 from crop, homestead, livestock and fisheries, respectively (Table 5). The average total variable cost of production in integrated farming over five years was Tk. 28451.

Table 4. Farm productivity and returns by intervention in different farming subsystems of integrated farm at FSRD site, Golapgonj, Sylhet during 2002-03

| Resources | | Technologies used and benefit drawn | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Type | Area (d) | Before intervention (1997-98) | | | | After intervention (2002-2003) | | | | |
| | | Technology | Prod. (kg) | GM (TK) | TVC (TK) | Technology | Prod. (kg) | GM (TK) | TVC (TK) | MBCR |
| a. Crop | | | | | | | | | | |
| MHL-1 | 30* | T. Aus (Local) | 195 G, 265 S | 1905 | 1816 | T. Aus (BR-26) | 552G,604S | 27980 | 8620 | 4.83 |
| | | | | | | T. Aman (BR-32) | 564G,651S | | | |
| | | T.Aman (Local) | 310 G, 426 S | | | Tomato (M, R) | 5785 | | | |
| MHL-2 | 8 | T. Aus (Local) | 74 G, 96 S | 609 | 793 | T. Aus (BR-26) | 157G,182S | 4715 | 1911 | 4.67 |
| | | | | | | T. Aman (BR-32) | 175G,205S | | | |
| | | T.Aman (Local) | 118G, 154 S | | | Brinjal | 340 | | | |
| | | | | | | Onion | 115 | | | |
| | | | | | | Cabbage (At-70) | 342 | | | |
| LL | 90* | | | | | Boro (BINA-6, BRRI Dhan-29) | 2160G, 2946S | 10245 | 4581 | 3.24 |
| MHL-3 | 50* | | | | | Mustard | 120G,198S | 1256 | 813 | 2.55 |
| Foot | 18 | | | | | Squash | 95 | 487 | 73 | 7.67 |
| Path | (pit) | | | | | Sweet gourd | 28 | | | |
| MHL-4 | 15 | | | | | Tomato | 2185 | 15627 | 4028 | 4.88 |
| | | | | | | Okra | 125 | | | |
| | | | | | | Lalshak | 100 | | | |
| | | | | | | Amaranth | 500 | | | |
| **Sub total** | **-** | | | **2514** | **2609** | | | **60310 (+2299%)** | **20025** | **4.32** |
| **b. Homestead** | | | | | | | | | | |
| Open land-1 | 17 | Country bean | 1710 | 11080 | 4338 | C. bean | 965 | 27994 | 6656 | 8.30 |
| | | | | | | Wax gourd | 1364 | | | |
| | | | | | | seedling | 32800 | | | |
| | | | | | | Sapling | 950 | | | |
| | | | | | | Mukhikachu | 156 | | | |
| | | | | | | Turmeric | 642 | | | |
| Thatches above ditch | 2 | | | | | B. gourd | 98 | 421 | 127 | 4.32 |
| Roof | | B. gourd | 100 | 350 | 20 | B. gourd | 127 | 657 | 47 | 12.37 |
| New plantation, Fertilization | | | | | | Guava (Kazi, BARI-1) | 344 | 2060 | 197 | 11.48 |
| | | | | | | Lemon (Seedless) | 252 | | | |
| | | | | | | Coconut | 25 | | | |
| Tree stem | | Not in use | | | | Potato yam | 44 | 335 | 50 | 7.70 |
| Open land-2 | 7.5 | | | | | Tomato (Manik,ratan) | 246 | 13852 | 2576 | 6.38 |
| | | | | | | Panikachu | 450 | | | |
| | | | | | | C. bean | 684 | | | |
| | | | | | | R. gourd | 54 | | | |
| Open land-3 | 10.5 | | | | | Panikachu | 150 | 1500 | 450 | 4.33 |
| Honey bee | | | | | | Honey | 7 | 5340 | 2710 | 2.97 |
| | | | | | | Box (sell) | 3 no. | | | |
| Silk cotton | | | | | | Silk cotton | 70 | 4200 | 665 | 7.32 |
| **Sub total** | | | | **11430** | **4358** | | | **56359 (+393%)** | **13478** | **5.93** |
| **c. Livestock** | | | | | | | | | | |
| Chicken | | Egg | 310 no. | 600 | 250 | Egg | 1670 no. | 3710 | 565 | 10.86 |
| Duck | | | | | | Egg | 1045 no. | 2060 | 364 | 6.65 |
| **Sub total** | | | | **600** | **250** | | | **5770 (+861%)** | **929** | **8.61** |
| **d. Fisheries** | | | | | | | | | | |
| Pond 1 | 12 | Traditional | 13 | 500 | 150 | Mixed polyculture | 340 | 9524 | 2376 | 5.05 |
| Pond 2 | 15 | Traditional | 14 | 700 | 200 | Mixed polyculture | 430 | 11932 | 3118 | 4.85 |
| Sub total | | | | 1200 | 350 | | | 21456 (+1688%) | 5494 | 4.94 |
| **Total** | | | | **15744** | **7567** | | | **143895 (+814%)** | **39927** | **4.96** |

Table 5. Economic comparison between farmer's old practice and newly adopted technologies of the farmer at FSRD Site, Golapgonj, Sylhet during 1997-98 to 2001-02

| Resource | Before intervention (1997-98) | | After intervention (Average of 98-99 to 02-03) | | MBCR | Benefit over (%) |
|---|---|---|---|---|---|---|
| | GM (Tk) | TVC (Tk) | GM (Tk) | TVC (Tk) | | |
| Crop | 2514 | 2609 | 41452.20 | 15184.40 | 4.10 | 1548.85 |
| Homestead | 11430 | 4358 | 39344.80 | 8618.00 | 7.55 | 244.22 |
| Livestock | 600 | 250 | 3868.40 | 785.12 | 7.11 | 544.73 |
| Fisheries | 1200 | 350 | 14310.20 | 3863.80 | 4.73 | 1092.52 |
| Total | 15744 | 7567 | 98975.6 | 28451.32 | 4.99 | 528.66 |

## Impact on Farm Income and Expenditure Pattern

The farm income consistently increased over the years due to continuous improvement of farm productivity due to adoption of improved technologies and addition of new enterprises and introduction of of-farm activities. Likewise the farm expenditure was also increased many folds for obvious reasons. The income and expenditure statement of the farm throughout the intervention period is shown in Table 6.

Table 6: Income and expenditure statement of the farmer (in Tk)

| Resources | Before intervention 1997-98 | After intervention (Tk) | | | | |
|---|---|---|---|---|---|---|
| | | 1998-99 | 1999-00 | 2000-01 | 2001-02 | 2002-03 |
| A. Income(Gross return) | | | | | | |
| Crop sub sector | 5123 | 43170 | 39280 | 45015 | 75383 | 80335 |
| Homestead sub sector | 15788 | 28743 | 48301 | 41966 | 50967 | 69837 |
| Livestock sub sector | 850 | 1300 | 4450 | 5020 | 5798 | 6699 |
| Fisheries sub sector | 1550 | 5200 | 11500 | 20220 | 27000 | 26950 |
| Off-farm | - | - | 22000 | 20000 | 11000 | 16000 |
| Total | 23311 | 78413 | 125531 | 132221 | 170148 | 199821 |
| B. Expenditure | | | | | | |
| Crop sub sector | 2609 | 9428 | 13191 | 15503 | 17775 | 20025 |
| Homestead sub sector | 4358 | 5300 | 7820 | 6772 | 9720 | 13478 |
| Livestock sub sector | 250 | 300 | 950 | 1020 | 726 | 929 |
| Fisheries sub sector | 350 | 1200 | 2800 | 3925 | 5900 | 5494 |
| Kachabazar | 3700 | 4100 | 3800 | 4200 | 4500 | 4850 |
| Food | 8000 | 9000 | 11000 | 12000 | 12500 | 13600 |
| Clothing | 2300 | 4800 | 5650 | 6230 | 7500 | 10600 |
| Education | 400 | 1650 | 1840 | 2200 | 2000 | 8000 |
| Mediacal | 700 | 1200 | 900 | 3000 | 1400 | 1800 |
| House repairing | - | 2600 | 3050 | 20000 | 2000 | 3800 |
| Refreshment | 400 | 1800 | 2300 | 2850 | 4000 | 5200 |
| Land purchase | - | - | 25000 | - | - | 48500 |
| Land development | - | - | - | - | - | 4200 |
| Marriage ceremony | - | - | - | - | 40000 | - |
| Paddle thresher | - | - | - | - | - | 21000 |
| Mobile | - | - | - | - | - | 9000 |
| Others | 220 | 800 | 1200 | 1500 | 1500 | 1900 |
| Distribution | 100 | 800 | 1000 | 1000 | 1200 | 1400 |
| Total | 23387 | 42978 | 80501 | 80200 | 110721 | 173776 |
| Balance | -76 | 35435 | 45030 | 52021 | 59427 | 26045 |

***Employment generation and women labour utilization***

After intervention more human labour was required for year round production activities. It was observed that unemployed labour of farm family had decreased with increase of crop intensification. The extra work created by intervention was shared among the family members. The total workload borne by women was more than men, but heavy work such as land preparation, load carrying, making trellis and marketing was done by men. Harvesting of vegetable, feeding of poultry, mulching and weeding of vegetable, seed processing and storing were done by women. It was observed that about 75% labour was supplied from the farmer's own family. The rest was supplied by the hired casual labour particularly in transplanting, weeding and harvesting of field crops. In homestead areas hired labour was required in repairing drainage system, making trellis etc.

***Impacts of interventions on family welfare***

Child education, clothing and house repairing cost increased due to enhanced income earned by the family (Table 6). In the year 2000-2001 medical cost slightly increased due to old age illness. Cost of kachabazar like vegetable, spices, fishes, eggs etc. are relatively static whereas the standard of living improved gradually. The dwelling house was expanded and household sanitary system was improved and purchased new furniture. The social activities of the farm family has also been increased remarkably.

***Sustainability of technologies and farmers reaction***

Now this family is treated as bank of seedlings of different vegetable and fruits. By using improved seedling raising techniques, he sells seedlings of different vegetable over the year. In the last three years he sold and distributed 138300 vegetable seedlings. He charted fertilizer doses of different fruits and showed in signboard, so that all the farmers of the area can be benefited. A 15-days training program on integrated farming (both male and female participants) jointly organized by members associated with this library and OFRD, BARI. The associate members of library cultivated mustard and tomato taking lease of fallow land of the area and this created encouragement among the farmers of the locality. Thus his residence worked as a center for technology transfer.

## Lebukhali FSRD Site, Patuakhali

The study was carried out with two farms representing the small and one farm representing the large category at Lebukhali FSRD site, Patuakhali - a predominantly tidally flooded area offering very limited scope of crop diversification. The study was initiated in 2001-02. The profile of the intervened farms is given in Tables 1 and 2.

Table 1. Family size and labor availability of the farms at Lebukhali site

| Type | Farmer I | | | Farmer II | | | Farmer III | | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Children (<15 Yr) | 3 | 2 | 5 | | - | - | 3 | 1 | 4 |
| Adult (15-60 Yr) | 3 | 1 | 4 | 3 | 1 | 4 | - | 1 | 1 |
| Old (>60 Yr0 | - | - | - | - | - | - | 1 | - | 1 |
| Total | 6 | 3 | 9 | 3 | 1 | 4 | 4 | 2 | 6 |
| Effective family labour | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 2 |
| Permanent hired labour | - | - | - | | | - | - | - | - |
| Casual hired labor | - | - | - | 1 | | 1 | - | - | - |

*Children are considered as half labor to calculate effective family labor.*

Table 2. Farm size of selected farmers at Lebukhali site

| Type | Area (decimal) | | |
|---|---|---|---|
| | Farmer I | Farmer II | Farmer II |
| Own cultivated land | 100 | 112 | 80 |
| Rented in/shared in | - | 160 | 100 |
| Mortgaged in | - | 120 | - |
| Fallow land | - | | |
| Hone stead | 85 | | |
| Pound/ditch | 8 | | |
| Orchard/Garden (out of HS) | 13 | | |
| Total | 126 | 732 | 270 |

### *Technologies used for intervention*

The technologies such as improved cropping patterns, crop management practices, sorjan cropping of vegetables, agro-fishery practices developed over the years at the site through farming systems research were used as interventions in relevant sectors. For livestock and fish production, technologies developed by BLRI and BFRI were used. A list of the technologies is given in Table 3.

Table 3. Technologies used for intervention

| *Crop Subsystem* | Technologies for intervention | Remarks |
|---|---|---|
| 1.Sorjan cropping | Bed-1 : Stem amranth – Okra – Bitter gourd – Red amaranth – Tomato – Country bean<br>Bed-2 : Indian spinach – Bitter gourd – Vegetable seedlings – Cabbage – Cauliflower – Country Bean<br>Bed-3 : Papaya + Chili + Ribbed gourd + Country bean<br>Bed-4&5 : Banana + Gimakalmi + Snake gourd + Red amaranth + Brinjal + Morma<br>Trellis over furrow: Creeper vegetables | For vegetable production in tidally flooded area. 28mx11m in 5 beds. |
| 2. Field crops | CP 1: Potato (No-tillage) –T.aus (BR-27) –T.aman (local )<br>CP2. Mungbean (BARI Mung 5) – T.aus (BR-27) – T. aman<br>New crop: Summer tomato | 20m long and 2.3m |
| *Homestead Subsystem* | | |
| 1. Year round vegetable production | Bed 1: Danta/ Ridged gourd - Tomato<br>Bed 2: Indian spinach – Potato<br>Bed 3: Danta – Kangkong - Brinjal<br>Bed 4: Kangkong - Lalshak + Radish<br>Bed 5: Ladies finger – Spinach/Cabbage | 9m x 9m in 5 beds |
| 2. Homestead trees | 1. Jujubi budding<br>2. Mango Hopper Control | |
| Agro-fishery in minipond | *North bank:*<br>Inner slope : Snake gourd – Bottle gourd<br>Bank top : Banana – Red amaranth / Brinjal<br>*East bank:*<br>Outer slope : Cucumber – Country bean<br>Inner slope : Snake gourd – Bitter gourd<br>Pond top – Piece 1 : Okra – Spinach / Ol kopy<br>Pond top – Piece 2 : Okra – Red amaranth / Ol kopy<br>*West Bank:*<br>Outer slope : Ribbed gourd – Country bean<br>Inner slope : Snake gourd – Bitter gourd<br>Pond top–Piece 1: Indian spinach–Red amaranth/ Cauliflower<br>Pond top–Piece 2: Indian spinach – Coriander / Tomato<br>*South bank :*<br>Inner slope : Snake gourd – Bitter gourd.<br>Pond top – Piece 1 : Radish – Brinjal.<br>Pond top – Piece 2 : Vegetable seedlings – Brinjal.<br>Fish: Rui : 20 Nos.<br>Catla : 20 Nos.<br>Silver carp : 30 Nos.<br>Common carp: 20 Nos. | |
| *Livestock subsystem* | 1. Broiler rearing<br>2. Vaccination to poultry birds<br>3. Deworming of cattle | |

Table 4. Extent of interventions made for improvement in different farms at Lebukhali FSRD site, Patuakhali

| Name of Technologies | Area coverage (Decimal/No.) | | | | | |
|---|---|---|---|---|---|---|
| | F-1 | | F-2 | | F-3 | |
| | 2001 | 2002 | 2001 | 2002 | 2001 | 2002 |
| Sorjon Cropping | - | - | 8 | 8 | - | - |
| Agro-Fishery Minipond | 9 | 9 | - | - | 9 | 9 |
| Potato ( No-tillage ) –T.aus (BR-27) –T.aman (L) . | 40 | 40 | 50 | 60 | 50 | 40 |
| Mungbean ( BARI Mung -5)-T.aus ( BR-27)-T.aman | 42 | 50 | 200 | 100 | 50 | 50 |
| Homestead Production : | | | | | | |
| Vegetable production round the year | 2 | 4 | 2 | 4 | 16 | 16 |
| Summer Tomato production | - | - | - | - | 2 | 4 |
| Mango hopper control (No.) | 5 | 5 | 8 | 8 | 4 | 4 |
| Top working on jujubee plants (No.) | 2 | 2 | 3 | 3 | 1 | 1 |
| Broiler rearing (No.×batch) | 200x3<br>100x2 | 200x5 | 200x3<br>100x2 | 200x5 | 200x5 | 200x5 |
| Deworming of Cattle (No.) | 3 | 3 | 5 | 5 | 3 | 3 |
| Vaccination to poultry birds (No.) | 10 | 15 | 15 | 15 | 35 | 30 |

**Farm Productivity**

Although the holistic approach was adopted, a partial intervention was made with respect to available resources in all the three farms. As such no attempt has been made to asses the overall farm productivity and income rather, the productivity of the interventions itself was evaluated deliberately. The productivity of the interventions is shown in Table 5.

Table 5. The overall productivity of different interventions of integrated farming (average of 3 farmers) at FSRD site, Lebukhali, Patuakhali

| Sector/ components | Before intervention yield (kg/ha) | After intervention yield (kg/ha) |
|---|---|---|
| *Field crops* | | |
| Mungbean | 500-600 | 1000-1200 |
| T.aus (local) | 2000-2200 | - |
| T.aus (MV) | 3000-3300 | 3500-4000 |
| T.aman (local) | 2500-2800 | 3000-3500 |
| T.aman (MV) | 3000-3500 | 3800-4500 |
| Chilli | 500-900 | 1000-1300 |
| Cowpea | 900-1000 | 1300-1500 |
| Zero tillage potato | - | 25000-30000 |
| *Agro-fishery mini pond* | | |
| Vegetables | - | 1370 |
| Fruits | - | 165 |
| Fish | - | 40 |
| Vegetable production round the year | - | 350 |
| *Sorjan cropping* | | |
| Vegetables | - | 510 |
| Fruits | - | 725 |
| Homestead production | | |
| Mango hopper control, Jujubee top working, management practices for fruit trees and creeper vegetables | - | 100-150% yield increased over farmers' practice |
| Livestock production Broiler/and layer | - | Tk 2000 nert return per batch of 100 birds. |

The productivity of field crops increased due to adoption of improved varieties of mungbean and rice, use of recommended management practices for each crop especially balanced fertilizer, weed control and pest management. System based technologies like No-tillage Potato-T.Aus-T.Aman and Mungbean-T.Aus-T.Aman cropping patterns sustained and increased productivity of each crop with balanced fertilizer management practices.

Sorjon cropping and Agro-fishery practices in mini pond also increased production of both vegetables and fish considerably. Homestead production system of all three farmers was very poor before intervention. Homesteads are usually densely planted with various trees many of which are unproductive. All homesteads are situated in raised land by digging pond(s). Vegetable growing space is very scarce. However, the homestead production system was intervened with year round vegetable production model and enough vegetables were produced for family consumption even in crisis periods. Mango hopper control produced tremendous effect to increase mango production.

In the livestock system, all farmers had cattle, poultry and duck, though the existing productivity was very poor. Broiler rearing, vaccination to poultry bird and deworming of cattle were introduced. Broiler rearing was a very new in the region and was very successful. Price of broiler chicken in local market was high in comparison to other area, but demand was somewhat low. Each farmer completed five batches of broiler within one year. The mortality rate was 2-3% and production was 1.5-1.7 kg per bird within 45 days of rearing. Only one farmer in a batch suffered serious mortality of birds from cold injury.

## Cost and returns

Both costs and returns increased due to integrated farming in all the farms. However, the rate of return on investment increased substantially in integrated farming and the MBCR of different subsystems ranged from 1.5 to 12.1. The overall MBCR ranged from 1.5-1.6 (Table 6).

Table 6. Cost and benefit of integrated farming (average of two years) at FSRD site, Lebukhali, Patuakhali

| Sector/practices | Before intervention | | | After intervention | | | MBCR |
|---|---|---|---|---|---|---|---|
| | TVC (Tk) | GR (Tk) | GM (Tk) | TVC (Tk) | GR (Tk) | GM (Tk) | |
| | | | Farmer-1 | | | | |
| Field crop production | 8743 | 14249 | 5506 | 23234 | 51068 | 27834 | 2.54 |
| Homestead production | 115 | 2580 | 2465 | 569 | 7013 | 6444 | 9.76 |
| Livestock production | - | - | - | 63600 | 82584 | 18984 | - |
| Total | 8858 | 16829 | 7971 | 87403 | 140665 | 53262 | 1.58 |
| | | | Farmer-2 | | | | |
| Field crop production | 49566 | 76245 | 26679 | 69813 | 117535 | 47722 | 2.04 |
| Homestead production | 445 | 4460 | 4345 | 891 | 9857 | 8966 | 12.10 |
| Livestock production | - | - | - | 62550 | 9857 | 18960 | - |
| Total | 50001 | 80705 | 31024 | 133254 | 208902 | 75648 | 1.54 |
| | | | Farmer-3 | | | | |
| Field crop production | 16347 | 27595 | 11248 | 30204 | 56516 | 26312 | 2.09 |
| Homestead production | 600 | 5410 | 4810 | 8410 | 24453 | 16043 | 2.44 |
| Livestock production | - | - | - | 41000 | 52650 | 11650 | - |
| Total | 16947 | 33005 | 16058 | 79614 | 133619 | 54005 | 1.6 |

## Labour utilization

Implementation of intervention generated a huge number of employments in all the farms in both genders. Specially, in implementing agro-fishery practices in mini pond, homestead vegetable production and broiler rearing, woman participation was higher (Table 7).

Table 7. Labour utilization (man days) of integrated farms at Lebukhali FSRD site, Patuakhali

| Sector/Practice | Before intervention | | | | After intervention | | | |
|---|---|---|---|---|---|---|---|---|
| | Own | | Hired | Total | Own | | Hired | Total |
| | Female | Male | | | female | Male | | |
| | | | Farmer-1 | | | | | |
| Field crop production | 20 | 32 | 18 | 70 | 36 | 47 | 37 | 120 |
| Homestead production | Negligible | | | | 4 | 2 | - | 6 |
| Livestock production | - | - | - | - | 30 | 30 | - | 60 |
| Grand total | 20 | 32 | 18 | 70 | 70 | 105 | 37 | 212 |
| | | | Farmer-2 | | | | | |
| Field crop production | 75 | 134 | 202 | 441 | 99 | 198 | 284 | 581 |
| Homestead production | - | - | - | - | 3 | 3 | - | 6 |
| Livestock production | - | - | - | - | 40 | 20 | - | 60 |
| Grand total | 75 | 134 | 202 | 441 | 142 | 221 | 284 | 647 |
| | | | Farmer-3 | | | | | |
| Field crop production | 28 | 62 | 36 | 126 | 65 | 98 | 48 | 211 |
| Homestead production | 6 | - | - | 6 | 52 | 58 | 26 | 136 |
| Livestock production | - | - | - | - | 25 | 11 | 74 | 383 |
| Grand total | 34 | 62 | 36 | 132 | 142 | 167 | 74 | 383 |

**Farm income and expenditure:**

Farm income and expenditure was the major criteria for measurement of living standard of co-operative farmers. Though it was very difficult to assess the actual income of and expenditure of a farm family due to unpredictable food cost, it was found that, after intervention, farm income and expenditure increased markedly in all the three farms. Before intervention, all three farmers were negative in their balance sheet (Table 8).

Table 8. Income and expenditure pattern of integrated farms at FSRD site, Lebukhali, Patuakhali

| Farmer | Before intervention | | After intervention | | | |
|---|---|---|---|---|---|---|
| | Expenditure (Tk) | Income (Tk) | Expenditure (Tk) | | Income (Tk) | |
| | | | 2001 | 2002 | 2001 | 2002 |
| Farmer-1 | 33118 | 37475 | 141543 | 148562 | 147885 | 158350 |
| Farmer-2 | 99211 | 97955 | 213104 | 226805 | 222402 | 241026 |
| Farmer-3 | 46047 | 48245 | 127214 | 136208 | 140289 | 146524 |

## Palima FSRD site, Tangail

Integrated farming system studies were carried out at FSRD site, Palima, Tangail for four years ending 2001-02 and an integrated system module for subsistence small farm livelihood system have been developed. The module have been published as a booklet and made available to all concerned. However, during the reporting year, the interventions were continued with four farms with particular emphasis to homestead based enterprises with a view to continue maximum utilization of homestead based resources for household food and nutrition security and income generation.

The result presented in the following tables indicates that depending on the area available and technologies adopted, the productivity varied considerably from farm to farm. But it is remarkable that by very negligible monetary investment and proper utilization of homestead land resources, sufficient vegetables and fruits may be produced for year round family consumption as well as substantial amount of cash income may be generated by selling the marketable surplus of the produce.

***Farm-1 (Small Category)***

Table-1. Cost and return from different vegetables patterns and fruits grown in the homestead area at FSRD site,Palima,Tangail during July/2002-April/2003

| Vegetables | Area (m2) | Yield(kg) | | | Total yield (kg) | Total value (Tk.) | TVC (Tk.) | GM (Tk.) |
|---|---|---|---|---|---|---|---|---|
| | | Rabi | K-1 | K-2 | | | | |
| ***Open sunny space*** | | | | | | | | |
| Lalshak-Indiaspinach-lalshak | 20 | 20 | 80 | 18 | 118 | 350 | 50 | 300 |
| Spinach-Amarath-Lalshak | 20 | 35 | 80 | 22 | 137 | 560 | 60 | 500 |
| Mula-Okra-Inian pinach | 20 | 110 | 30 | 70 | 210 | 765 | 40 | 725 |
| Gardenpea-Gimakalmi-Gimakalmi | 20 | 22 | 90 | 80 | 192 | 670 | 60 | 610 |
| Lalshak-Lalshak-Lalshak | 20 | 25 | 22 | 20 | 67 | 268 | 25 | 243 |
| *Total* | -- | *212* | *302* | *210* | *724* | *2613* | *235* | *2378* |
| ***Trellis*** | | | | | | | | |
| BARI lau-1-Ash gourd | 20 | 10 | 20 | -- | 30 | 260 | 25 | 235 |
| BARIsheem-1-S.gourd-B. gourd | 20 | 80 | 30 | 10 | 120 | 670 | 40 | 630 |
| Country bean-S.gourd-S.gourd | 20 | 40 | 25 | 8 | 73 | 364 | 20 | 344 |
| *Total* | -- | *130* | *75* | *18* | *223* | *1294* | *85* | *1209* |
| **Grand Total(1-2)** | | **342** | **377** | **228** | **947** | **3907** | **320** | **3587** |

### Fruit Trees:

| Name of fruits | No. of Trees | Yield (kg) | Total value (Tk.) | TVC (Tk.) | GM (Tk.) |
|---|---|---|---|---|---|
| Olive | 02 | 440 | 4400 | 50 | 4350 |
| Lemon | 01 | 04 | 100 | --- | 100 |
| Papaya | 3 | 40 | 200 | 20 | 180 |
| Dates | 01 | 30 | 300 | 20 | 280 |
| Mango | 04 | 80 | 800 | 40 | 760 |
| BARI litchi-1 | 02 | 10 | 1200 | 40 | 1160 |
| Total | -- | 604 | 7000 | 170 | 6830 |
| **Grand Total(1-3)** | | **1551** | **10907** | **490** | **10417** |

**Farm-2 (Small category)**

Table-2. Cost and return from different vegetables patterns and fruits grown in the homestead area at FSRD site,Palima,Tangail during July/2002-April/2003

| Vegetables patterns | Area ($m^2$) | Yield (kg) | | | Yield (kg) | Return (Tk.) | TVC (Tk.) | GM (Tk.) |
|---|---|---|---|---|---|---|---|---|
| | | Rabi | K-1 | K-2 | | | | |
| *Open sunny space* | | | | | | | | |
| Potato –Indian spinace-Chill | 20 | 38 | 17 | 19 | 74 | 824 | 215 | 607 |
| Lalshak-Lalshak-Indian spinach | 20 | 10 | 18 | 25 | 53 | 378 | 50 | 338 |
| Amaranth-Amaranth-Lalshak | 20 | 28 | 25 | 15 | 68 | 505 | 60 | 435 |
| Tomato-Lalshak/okra | 20 | 25 | 10 | 25 | 60 | 495 | 70 | 425 |
| Potato-Okra-G.kalmi | 20 | 40 | 25 | 65 | 130 | 875 | 150 | 725 |
| G.kalmi-G.kalmi-G.kalmi | 20 | 120 | -- | -- | 120 | 720 | 50 | 670 |
| Tomato-Okra-Dancha | 20 | -- | 50 | 300 | 470 | 1800 | 300 | 1500 |
| Total | | 261 | 145 | 449 | 975 | 5597 | 895 | 4702 |
| *Trellis* | | | | | | | | |
| BARI lau-1-Sweet gourd | 40 | 50 | 25 | - | 75 | 450 | 150 | 300 |
| BARIsheem-1-S.gourd/sp.gourd | 30 | 62 | 10 | 33 | 105 | 1016 | 200 | 186 |
| Country bean-Ash gourd | 30 | 58 | 40 | - | 98 | 676 | 200 | 476 |
| Bitter gourd round the year | 20 | 40 | - | - | 40 | 600 | 100 | 500 |
| Sheem-sweet goyurd | 15 | 20 | 50 | - | 70 | 510 | 150 | 340 |
| Sheem -cucumber | 12 | 25 | 20 | - | 45 | 350 | 150 | 200 |
| Total | | 255 | 145 | 33 | 433 | 3602 | 950 | 2652 |
| *Shady area* | | | | | | | | |
| Nut seedling | 12 | 200 (no.) | - | - | - | 600 | 60 | 540 |
| *Marshy area* | | | | | | | | |
| Latiraj Kachu | 30 | 80 | - | - | 80 | 960 | 50 | 910 |
| P*ond bank* | | | | | | | | |
| Sweet gourd | 40 | 100 | - | - | 100 | 560 | 50 | 510 |
| BARI sheem-1 | 10 | 40 | - | - | 40 | 320 | 50 | 270 |
| *Back yard* | | | | | | | | |
| Potato yam | 2(no.) | 12 | - | - | 12 | 120 | - | 120 |
| *Fruit trees* | | | | | | | | |
| Seedless lemon | 01 | 200 (no) | - | - | 200 | 400 | - | 400 |
| Papaya | 160 | 680 | - | - | 680 | 4780 | 200 | 4580 |
| Baromasy drumstick | 01 | 10 | 8 | - | 18 | 270 | - | 270 |
| Total | | 1322 | 8 | | 1130 | 8010 | 410 | 7600 |
| Grand Total | | 1838 | 298 | 482 | 2538 | 17209 | 2255 | 14954 |

***Farmer-3***

Table 3. Cost and return from different vegetables patterns and fruits at homestead area in FSRD site,Palima,Tangail during July/2002-April/2003

| Vegetables pattern | Area ($m^2$) | Yield(kg) | | | Total yield (kg) | Total value (Tk.) | TVC (Tk.) | GM (Tk.) |
|---|---|---|---|---|---|---|---|---|
| | | Rabi | K-1 | K-2 | | | | |
| *Open sunny space* | | | | | | | | |
| Mula-Mula –Indian spinace | 16 | 25 | 120 | 110 | 255 | 985 | 150 | 835 |
| G.kalmi-Amaranth-Lalshak | 16 | 15 | 60 | 8 | 83 | 370 | 30 | 340 |
| Garlic-Okra-Lalshak | 16 | 3 | 35 | 5 | 43 | 365 | 60 | 305 |
| Tomato-patshak-Amaranth | 16 | 25 | 30 | 50 | 105 | 550 | 55 | 495 |
| Mula-Lalshak-Okra | 16 | 117 | 5 | 20 | 142 | 536 | 75 | 461 |
| G.kalmi-G.kalmi-G.kalmi | 16 | 25 | 40 | 45 | 110 | 880 | 50 | 830 |
| Total | | 210 | 290 | 238 | 738 | 3686 | 420 | 3266 |
| *Trellis* | | | | | | | | |
| BARI lau-1-Ash gourd | 2 +2 (no) | 30 (no.) | 40 (no) | - | 225 | 700 | 30 | 670 |
| BARIsheem-1-Cucumber | 3 +3 (no) | 120 | 10 | - | 130 | 1060 | 20 | 1040 |
| Total | | | | | 355 | 1760 | 50 | 1710 |
| *Shady area* | | | | | | | | |
| Zinger | 10m2 | | | 05 | 05 | 200 | 20 | 180 |
| *Marshy area* | | | | | | | | |
| Kachu | 10 | 50 | - | - | 50 | 150 | -- | 150 |
| *Pond bank* | | | | | | | | |
| Naper grass | 10 | 30 | - | - | 30 | 60 | -- | 60 |
| *Back yard* | | | | | | | | |
| Potato yam | 3 (no.) | 12 | - | - | 15 | 150 | - | 150 |
| *Fruit trees* | | | | | | | | |
| Seedless lemon | 04 | 15 | - | - | 15 | 225 | - | 225 |
| Papaya | 05 | 75 | - | - | 75 | 600 | 50 | 550 |
| Banana | 05 | 250 (no) | - | - | 62 | 250 | 30 | 220 |
| Guava | 10 | 300 | - | - | 300 | 3600 | 100 | 3500 |
| Mango | 03 | 200 | - | - | 200 | 3000 | 150 | 2850 |
| Juckfruit | 03 | 15 (no) | - | - | 15 | 225 | -- | 225 |
| Nut | 06 | 15 | - | - | 15 | 750 | -- | 750 |
| Total | | | | | 782 | 9210 | 350 | 8860 |
| GrandTotal(1-7) | | | | | 1875 | 14656 | 820 | 13836 |

***Farmer-4***

Table4. Cost and return from different vegetables patterns and fruits grown in the homestead area at FSRD site,Palima,Tangail during July/2002-April/2003

| Vegetables | Area (m2) | Yield(kg) | | | Total yield (kg) | Total value (Tk.) | TVC (Tk.) | GM (Tk.) |
|---|---|---|---|---|---|---|---|---|
| | | rabi | K-1 | K-2 | | | | |
| *Open sunny space* | | | | | | | | |
| Lalshak-Amarath-Amaranth | 16 | 10 | 39 | 124 | 173 | 589 | 100 | 489 |
| Mula Patshak-Amaranth | 16 | 50 | 17 | 10 | 177 | 716 | 200 | 516 |
| G.kalmi-G.kalmi-G.kalmi | 16 | 30 | 33 | 30 | 93 | 465 | 50 | 415 |
| Amaranth-Indianspinach-amaranth | 16 | 35 | 39 | 124 | 198 | 594 | 100 | 494 |
| Chilli-Chilli-Chilli | 16 | 3 | 2 | 4 | 9 | 180 | 25 | 155 |
| Total | | 128 | 130 | 292 | 650 | 2544 | 475 | 2069 |
| *Back yard* | | | | | | | | |
| Potato yam | 03 | | | | 50 | 500 | 20 | 480 |
| *Fruit trees* | | | | | | | | |
| Seedless lemon | 04 | 12 | - | - | 12 | 300 | - | 300 |
| Papaya | 10 | - | - | | 290 | 1450 | 200 | 1250 |
| Guava | 05 | 45 | | | 45 | 450 | 100 | 350 |
| Mango | 03 | 200 | | | 200 | 3000 | 150 | 2850 |
| Juckfruit | 01 | 15(no) | | | 15 | 225 | -- | 225 |
| Total | | | | | 612 | 5925 | 470 | 5455 |
| Grand Total | | | | | 1262 | 8469 | 945 | 7524 |

# A STUDY ON FARMER'S PRACTICE OF GROWING LOTKON (*Baccaurea sapida)* AT SHIBPUR, NARSINGDI


## Abstract

A study was carried out at Shibpur MLT site, Narsingdi to know the agronomic and economic potentials of lotkon, associated problems and to identify researchable issues for the development of lotkon during December'02 to January'03. Fifty lotkon growing farmers from Shibpur Upazila under Narsingdi district were selected randomly for collecting data. On an average, farmers of this area have been growing lotkon for 14 years. Average area was 0.45 ha with 113 plants per farm. Most of the farmers (68%) planted lotkon under the shade of Jackfruit trees while some (22%) planted lotkon to both mango and Jackfruit. Average fruit yield was recorded 60 kg/plant while the mean highest-ever fruit yield was 96 kg/plant. On an average, Tk.1500/- could be earned from a single tree whereas gross margin per hectare was Tk. 342250/-. A high level of benefit-cost ratio (22.83) indicated that Lotkon was a highly profitable crop. Family labour was utilized well in growing Lotkon as farmer along with his children performed most of the activities like pit preparation, planting, harvesting, marketing etc.


## Introduction

Lotkon (*Baccaurea sapida* Muell.-Arg.) is a fruit having taste acid to sweet. It is known as 'Bhubi' in some places of Bangladesh. It is also known as Burmese grape, called tempui in Malaya, lutqua in India and mai fai in Thailand (Morton 1987). FAO reported that the species *Baccaurea sapida* (Roxb.) Muell.-Arg. is synonyms of the species (Mafai) *Baccaurea ramiflora* Lour. and *B. wrayi* King ex Hook.f., belongs to the family Euphorbiaceae. It is native to southeast Asian region and found growing wild as well as under cultivation in Nepal, India, Myanmar, South China, Indo-China, Thailand, the Andaman Islands, and Peninsular Malaysia. The tree can grow up to 25 m tall. The leaf is simple, alternately arranged, with petiole. It is ovate to ovate lanceolate in shape and 10-20 x 4-9 cm in size. Tomentose inflorescences appear on branches and on the trunk. The male racemes are 3-8 cm long; flowers are fascicled on very short rachises with 4-5 sepals, and 4-8 stamens. The female racemes are 14 cm long and are bome lower on the trunk. Female flowers are solitary, with 4-5 sepals, 3-locular ovary and 2-lobed stigmas. The fruits are glabrous and 2.5-3.0 cm in diameter. The fruits can be of various colours from yellowish, pinkish to bright red. Morton (1987) described about *B. sapida* as "The tree grows to 30 or even 70 ft (9-21m). Leaves are rarely and then slightly hairy; male and female flowers are bome on separate trees. Fruit, in strands 6 to 12 inch (15-30 cm) long, is smooth, nearly round or oval, 1 to 11/4 inch (2.5-3.2 cm) long; skin turns from ivory to yellowish or pinkish-buff or sometimes bright-red. The pulp is not translucent; is whitish, occasionally deep-pink near the seeds; varies from acid to sweet". In Bangladesh, lotkon is popular to people of all ages. It comes to market during the months of June-July. Still it is a minor crop but price is equivalent or higher than good varieties of mango. Recently lotkon has got importance as an exportable item to foreign countries, particularly middle-east and Europe. From this point of view, it is the high time to give proper attention to this crop. Narsingdi district is well known for growing Lotkon. Farmers of some unions under Shibpur Upazila grow Lotkon extensively. Literature regarding this crop was rare and only botanical description was found from literature search through internet. So, there was a need to record its existing agronomic practices, potentials and problems and socio-economic aspects as well. Hence the study was designed to achieve the following objectives.

- To know the management practices of growing Lotkon
- To assess present agronomic and economic potential of Lotkon
- To identify problems associated with Lotkon cultivation
- To identify researchable issues for the development of Lotkon

## Materials and Methods

The study was carried out at Multi-location Testing (MLT) site under On-Farm Research Division (OFRD), Bangladesh Agricultural Research Institute (BARI), Shibpur, Narsingdi during December 2002 to January 2003. Shibpur Upazila under Narsingdi district was selected purposively as the farmers of this area grow Lotkon extensively. The study area included the villages namely, Askitala, Joynagar, Ashtaani, Gilaber of Joynagar Union and the villages Murgiber and Naukaghata of Josohar Union under Shibpur Upazila of Narsingdi district. Data were collected from randomly selected 50 Lotkon growing farmers. A group of researchers conducted farmers' interview to collect data using pre-tested questionnaire. After verification and compilation, data were analyzed statistically and presented in tabular form.

## Results and Discussions

### 1.0 The Lotkon plant and its environment

It was found that lotkon grows well under shade of other trees but also grows in open field. Most of the farmers (68%) planted lotkon considering Jackfruit as shading tree i.e. spaces in between Jackfruit trees, some farmers (22%) have planted lotkon to both of mango and Jackfruit while others planted under mango only. According to FAO, it is cultivated in the home garden and intercropped with other tropical fruits like durian, rambufan, and mango. The land type of the lotkon growing areas was high land belongs to Madhupur Tract having red clay soils (AEZ 28). On an average, farmers of this area have been growing lotkon for 14 years (range: minimum 5 to maximum 35 years). Area under lotkon cultivation per farm was on an average 0.45 ha (with range: min. 0.16 ha to max.1.75 ha). Number of lotkon trees per farm varied from 25 to 560 with an average of 113 trees per farm. However, average number of trees per hectare was 246.

### 2.0 Farmer's practices for growing Lotkon

2.1 *Propagation*: From Table-1 it was found that all farmers (100%) under study used saplings of local variety as the propagating material. Seeds were used to raise saplings. According to FAO, fresh seeds germinate in a matter of day, therefore, seed germination is the common method of propagation. Farmers collected saplings mostly (92%) from local sources while only 8% of the respondents used seedlings from own source.

2.2 *Land and pit preparation*: None of the farmers' ploughed land before planting Lotkon, rather 100% of them planted sapling by making pit. The size of pit varied from one farmer to another but most of the respondents (86%) mentioned approximate size of the pit as 30 x 30 x 30 cm (Table 1). The pit was prepared on the same day of planting in most cases (86%).

2.3 *Planting time*: 50% of the farmers planted Lotkon during June-July while 45% of them planted saplings in June (Jaisthya-Ashar) and rest of the farmers in August-September.

2.4 *Plant* s*pacing*: In most (78%) cases plant to plant spacing of Lotkon was 4-5m. However, 8% of the respondents planted saplings at 6-7m spacing while others planted saplings at spacing of 8m or more.

2.5 *Application of fertilizers and manures*: None of the farmers applied any manure or fertilizer in the pit before planting seedlings but 42% of the respondents applied 15-20 kg cow dung to growing or fruiting plants but not regularly.

2.6 *Intercultural operations*: About 26% of the respondents pruned their Lotkon trees once during August-September (Bhadra), 8% of the respondents pruned the trees during September-October (Ashwin) while others did not practice pruning (Table 1). None of the respondents applied irrigation or weeded the Lotkon field.

2.7 *Ratio of male and female plants*: In most cases (62.5%), farmers did not allow male plants to grow. Others allowed some male plants in their garden but the ratio varied widely. In 15% cases, the ratio was 1: 4-10 (male: female), the ratio 1: 11-20 was also found in 15% cases and in 7.5% cases the ratio was 1: 22 & above (Table 1).

Table 1. Farmer's management for growing Lotkon at Shibpur, Narsingdi

| Practice | Farmer's response | % of respondents |
|---|---|---|
| 1. Propagating material | ▪ Sapling | 100 |
| 2. Source of propagating materials | ▪ Locally collected | 92 |
| | ▪ Owned | 8 |
| 3. Variety of Lotkon | ▪ The local variety only | 100 |
| 4. Land preparation | ▪ Did not plough land | 100 |
| 5. Planting technique | ▪ Making pit | 100 |
| 6. Time of pit preparation | ▪ Same day | 86 |
| | ▪ 1-4 days before planting | 10 |
| | ▪ 5-10 days before planting | 4 |
| 7. Size of the pit | ▪ 30 x 30 x 30cm (approx) | 86 |
| | ▪ 23 x 23 cm (approx.) | 6 |
| | ▪ No definite size | 8 |
| 8. Spacing (plant to plant) | ▪ 4 – 5 m | 78 |
| | ▪ 6 – 7 m | 8 |
| | ▪ 8 & above | 14 |
| 12. Planting time | ▪ June (Jaistha-Ashar) | 45 |
| | ▪ June-July (Ashar-Shravan) | 50 |
| | ▪ Aug-Sept (Bahdra-Ashwin) | 5 |
| 13. Application of manures & fertilizers in pit | ▪ Did not apply | 100 |
| 14. Fertilizer application to growing/fruiting plants | ▪ Did not apply | 58 |
| | ▪ 15-20 kg CD/plant | 42 |
| 15. Irrigation | ▪ Did not apply | 100 |
| 16. Pruning | ▪ Once during Aug-Sept | 26 |
| | ▪ Once during Sept- Oct (Ashwin) | 8 |
| | ▪ Did not practice | 66 |
| 17. Weeding | ▪ Did not practice | 100 |
| 18. Shading tree to which Lotkon has grown as mixed/inter crop | ▪ Jackfruit | 68 |
| | ▪ Mango | 10 |
| | ▪ Both Jackfruit & Mango | 22 |

2.8 *Shading trees*: About 68 per cent of the respondents had grown Lotkon in association with Jackfruit while 22% of them planted Lotkon to both Jackfruit and Mango (Table 2). Age of most (45%) of the shading trees varied from 41-60 years and were planted at plant to plant spacing of 5 to 10 m in most (65%) cases. Lotkon was planted more than 5m apart from the nearest shading tree in most cases (67%) while rest of respondents (33%) planted Lotkon at a distance of 3-5m from the shading trees (Table 2).

Table 2. Shading trees used by farmers for growing Lotkon at Shibpur, Narsingdi

| Practice | Farmer's response | % of respondents |
|---|---|---|
| 1. Shading tree to which Lotkon has grown as mixed/inter crop | ▪ Jackfruit | 68 |
| | ▪ Mango | 10 |
| | ▪ Both Jackfruit and Mango | 22 |
| 2. Age of the shading trees | ▪ 10-20 yrs | 25 |
| | ▪ 21-40 yrs | 30 |
| | ▪ 41-60 yrs | 45 |
| 3. Spacing of the shading trees | ▪ 5 – 10m | 65 |
| | ▪ Above 10m | 35 |
| 4. Age of Lotkon trees | ▪ 6-10 years | 30 |
| | ▪ 11-15 years | 45 |
| | ▪ 16 & above | 25 |
| 5. Distance of Lotkon from shading tree | ▪ 3 – 5m | 33 |
| | ▪ Above 5m | 67 |

2.9 *Fruit harvest*: Most (50%) of Lotkon plants belonged to 11-15 years of age (Table 2). Fruits were first harvested 3-4 years after planting saplings (farmers planted 3-3.5 year old saplings). Fruits were harvested mostly during June-July in a single harvest and the harvest duration extends for one month. In Thailand the fruits are harvested in June-July (FAO). Farmers determined the harvesting stage by yellow colour of the fruits.

2.10 *Post harvest operations*: They did not practice any post harvest operations except arrange them in the basket and/or transport for marketing.

2.11 *Shelf-life*: According to farmers, Lotkon could be stored for 1-2 days only. It got discolour quickly. Farmers did not face any problem for storing the crop as they sold it immediate after harvest.

## 3. 0 Agronomic and Economic Potential of Lotkon

3.1 Agronomic potentiality of Lotkon

According to most of the farmers, fruit set in Lotkon was usually well and in some cases, huge fruits starting from base of the trunk to the branches were observed. Average fruit yield/plant was recorded 60 kg while the mean highest-ever yield (farmers were asked to mention the highest fruit yield/tree irrespective of age they obtained so far) was 96 kg/plant. On an average, there were 246 Lotkon trees per hectare and thus yield obtained last year was 13.69 t/ha. However, the highest-ever fruit yield as mentioned by the farmers was on an average 16.63 t/ha (Table 3).

Table 3. Showing the yield potential of Lotkon at Shibpur, Narsingdi

| Potential yield | Mean | Range | | Standard Deviation |
|---|---|---|---|---|
| | | Max. | Min. | |
| Per plant (kg) | 60 | 19 | 120 | 4.72 |
| Per hectare (ton) | 13.69 | 3.43 | 32.16 | 7.21 |
| Highest ever | | | | |
| per plant (kg) | 96 | 35 | 168 | 6.68 |
| per hectare (ton) | 16.63 | 4.01 | 37.23 | 8.03 |

3.2 Economic potentiality

All most all (98%) respondents mentioned that they got appropriate price of Lotkon and faced no problem for its marketing. It was found that, on an average, Tk. 1500/- could be earned from a single Lotkon tree. They earned a high gross margin of Tk. 327258/ha. Total cost of production included labour (Tk. 6800/ha), sapling cost (Tk. 2460/ha), transportation cost (Tk. 2744/ha) and the cost for cow dung (Tk. 2988/ha) was also considered as 42% of the farmers applied it to growing /fruiting plants. Benefit-cost ratio (22.83) revealed that Lotkon was a highly profitable crop (Table 4). All Lotkon growing farmers under study mentioned that their economic condition had improved positively due to Lotkon cultivation and they expressed interest to grow Lotkon in more land as the crop was profitable.

Table 4. Economics of Lotkon cultivation at Shibpur, Narsingdi

| Average gross return/tree (Tk) | Gross return (Tk/ha) | Total cost of production (Tk/ha) | Gross margin (Tk/ha) | BCR |
|---|---|---|---|---|
| 1500/- | 342250/- | 14992/- | 327258/- | 22.83 |

Price of Lotkon = Tk. 25/kg

## 4.0 Socio-economic aspects of Lotkon cultivation

### 4.1 Marketing of Lotkon

Most of the respondents (64%)sold their produce in the local market. About 26% of the farmers sold Lotkon from both garden and market while 10% from garden only. In most cases (86%) farmers sold their produce to the Bepari while others sold to both Bepari and ultimate consumers. None of respondent faced any problem in marketing of Lotkon

### 4.2 Involvement of labour

Lotkon was not found a very labour intensive crop. Once it was planted, no labour was required until it started bearing fruits, as farmers did not practice any intercultural operation except applying cowdung to growing/fruiting trees in some cases. Hence, requirement of labour was mostly for harvesting and marketing of the fruits. Labour required for different activities for growing Lotkon are presented in Table 5.

Table 5.Labour requirement for growing Lotkon at Shibpur, Narsingdi

| Activity | Required labour/ha | | |
|---|---|---|---|
| | Hired | Family | Total |
| 1. Pit preparation | 10 | 5 | 15 |
| 2. Seedling planting | 5 | 5 | 10 |
| 3. Intercultural operations | 15 | 5 | 20 |
| 4. Harvesting | 20 | 5 | 25 |
| 5. Marketing | 10 | 5 | 15 |
| **Total** | **60** | **25** | **85** |

### 4.3 Utilization of family labour

According to all of the respondents (100%), family labour (including farmer himself, wife and children i. e. son and daughter) were utilizing in different activities for growing Lotkon but their degree of participation varied depending on the nature of activity. Farmer himself actively participated in all of the activities needed for Lotkon cultivation. Table 4 showed that farmer along with his children performed most of the activities like pit preparation (42%), seedling planting (48%), and intercultural operations (62%) etc. While 60% of harvesting and 76% of marketing of the crop was done by farmer and his children along with hired labour. However, farmer himself, children and his wife performed maximum (44%) of the processing activity (to make Lotkon ready for marketing) after harvest.

Table 6. Utilization of family labour in Lotkon cultivation at Shibpur, Narsingdi

| Activity | Involvement of labour (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| | f | f-l | f-ch | f-ch-l | f-w | f-w-ch | f-w-l |
| 1. Pit preparation | 2 | 24 | 42 | 24 | - | 8 | - |
| 2. Seedling planting | 2 | 14 | 48 | 32 | - | 2 | 2 |
| 3. Intercultural operations | 4 | 12 | 62 | 14 | - | 8 | - |
| 4. Harvesting | 4 | 28 | - | 60 | - | 8 | - |
| 5. Marketing | - | 16 | 4 | 76 | 4 | - | - |

Note: f = farmer; ch = children; w= wife and l = hired labour

### 4.4 Disposal pattern of Lotkon

Farmers sold out most (98%) of the Lotkon grown in their garden. Rest of the produce was consumed by own family members and gifted to relatives or neighbours. Most (58%) of the respondents mentioned that all members of the family like to consume Lotkon while according to others children consumed Lotkon most.

4.5 Countries of exporting Lotkon

It was known to most of the farmers that Lotkon was exported to foreign countries but most (92%) of them could not mention name of the countries. According to some farmers, Lotkon were exported to Middle East countries. Some other mentioned the countries like Japan and UK.

4.6 Farmer's preference to Lotkon

Farmers were asked to rank eight fruits (including Lotkon) with taste close to Lotkon but most common and locally available. Lotkon occupied 4th position in order of preference by 70 per cent of the respondents while mango was in 1st position according to 98% of respondents (Table 6).

Table 7. Farmer's preference to Lotkon compared to some other fruits at Shibpur, Narsingdi

| Fruits | Ranked by farmers (%) | Rank offered |
|---|---|---|
| Mango | 98 | 1st |
| Litchi | 68 | 2nd |
| Orange | 60 | 3rd |
| Lotkon | 70 | 4th |
| Pomello | 34 | 5th |
| Hog pulm | 48 | 6th |
| Guava | 56 | 7th |
| Black berry | 62 | 8th |

4.7 Farmer's suggestion for the improvement of Lotkon

Suggestions as mentioned by the farmers were as follows.

i. Yield of Lotkon may be increased through fertilizer application and controlling flower and fruit drop.

ii. Lotkon got discolour and rotten very quickly. Arrangement of cold storage can help better marketing and ensure higher price of the crop.

**5.0 Problems Associated with Lotkon Cultivation**

The only significant problem as mentioned by the farmers was drying of branches from the tip i.e. die back. It is assuming that there might have a relation with pruning during August-September to this problem (die back). Of course, the actual cause for the problem should be identified. Among other problems flower and fruit drop might get consideration. Problems regarding Lotkon cultivation as mentioned by the respondents are mentioned in Table 8.

Table 8. Problems regarding Lotkon cultivation as mentioned by the respondents

| Problem | Number of citation |
|---|---|
| 1. Branches get dried from the tip (die back) | 48 (52.7%) |
| 2. Red insect damage leaves | 8 (8.8%) |
| 3. Curling of leaf | 2 (2.2%) |
| 4. Flower drop | 15 (16.5%) |
| 5. Fruit drop | 10 (10.9) |
| 6. Theft | 05(5.5%) |
| 7. Quarrel with neighbours | 03 (3.4%) |
| **Total** | **91 (100%)** |

**6.0 Research and Development Issues**

i. Identification of insect-pest and diseases and/or other causes affecting the yield of Lotkon and recommendation/development of suitable control measures.

ii. Assessment of actual yield potential of Lotkon considering age of the plant, number of trees/unit area in the Jackfruit-Lotkon and Mango-Lotkon system, and also total yield potential of the cropping systems per unit area (from Agro-forestry perspective).

iii. Development of appropriate agronomic practices like, land and pit preparation, spacing, application of fertilizer and manures, weeding, pruning/training, irrigation for higher yield of Lotkon under Jackfruit-Lotkon and Mango-Lotkon system.

iv. Determination nutritive value of green and ripe fruit and also processed food items.

v. Study on storability i.e. shelf-life of Lotkon and to find suitable and simple storing technique(s) to tackle the problem of short shelf-life of Lotkon.

vi. Preparation of different processed food items like, fresh fruit packed in small container without preservative, pickle, jam/jelly, cooked food items etc.

vii. To find out the marketing channel of Lotkon

viii. Some basic research is needed to know growth habit, adaptation to variable environment, genetic variability, mode of pollination, propagation, male and female ratio, identification of male and female plant at early stage of growth etc.

## Conclusion

Lotkon is a highly potential crop from both agronomic and economic point of view. There is a vast scope to explore and exploit potentiality of the crop. Development of appropriate agronomic practices including planting technique, fertilizer management, intercultural operations, management of inter/mixed crops etc. along with insect-pest management and post-harvest technologies will greatly increase yield and economic potentiality of the crop. Higher price and export value of the crop further emphasized to draw attention to take care of it at the moment. Cultivation of lotkon may be extended all over the Modhupur Tract and other parts of the country having identical land and soil. Adaptability to variable land and soil should be tested to identify more area for its extrapolation.

**Reference:**

Morton, J, 1987. Fruits of warm climates. p. 220. www.hort.purdue.edu/newcrop/morton/index.html

FAO. http://www.fao.org/DOCREP/004/AB777E/ab777e04.htm

# YIELD GAP ANALYSIS OF POTATO UNDER DIFFERENT MANAGEMENT SITUATION IN BANDARBAN AREA


## Abstract

The study was conducted at Bandarban Sadar during 2002-03 to find out the causes of difference between yield level that obtained with better practice farmers plot and average practiced farmers plot. Results of the study revealed that yield gap between two farmers practice plot was found 4220 kg (27%) per hectare as well as gross margin gap was Tk.32825/ha. Cobb-Douglas production model, it was estimated that the key factors behind yield gap: TSP, MP and draft power significantly influenced on yield of potato. The research suggest that this apparent yield and economic gap can be minimized at farm level to follow recommended package of technologies and fertilizer should be ensured locally in reasonable price in time.


## Introduction

Potato is grown in a limited area in Bandarban district especially at Balagata, Muslim para. Farmers are widely grown with local variety. It is usually observed that the yield of potato in farmers field differ from that obtained in research station or demonstration plot due to varietal performance of potato. In Bandarban areas most of the farmers cultivate local variety called dohajari variety of potato with traditional management practices resulting low average yield compared to HYV. The farmers do not follow recommended practices. But there are some farmers whose management is better compared to the average farmers and thus obtain better yield. In order to increase the production of potato to its maximum possible extent at farm level, it is necessary to identify the factors behind this yield. The study is, therefore, designed to estimate the yield and benefit differences of potato under two management practices and to identify the factors behind yield gap of potato cultivation. So, the study has been under taken with the following objectives:

- to find out the level of technology employed or input use of potato production at different situation;
- to estimate the yield and benefit gap of potato between two practice plot;
- to identify the factors that is responsible for yield gap of potato , So that policy can be made accordingly.

## Materials and Methods

A total of 40 farmers plot were selected for the study which 20 plots were better practice farmers plot and 20 were average practice farmers plot. The first group who got comparatively higher yield and the rest were the lower yield. A total of 40 plots of 40 farmers were selected randomly to collect primary data. After collection of primary data the whole set were classified into above-mentioned two groups. Data for the study were collected during March-April, 2003 through survey method by using a pre-tested survey schedule.

### Analytical technique of yield gap analysis

Cobb-Douglas production function was selected to quantify the relative contribution of different production factors to the yield gap between better practice and average practice farmers plot. Cobb-Douglass production function was used separately in order to identify the relative contribution of different production factors to the yield gap.

The Cobb-Douglas functional form of the multiple regressions is as follows:

$$Y = a\ X_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}\ X_7b^7X_8b^8$$

The function can be linearised by transforming it into the logarithmic form:

$$\text{Log } Y = \text{Log } a + b_1\text{Log}X^1 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots + b_8\text{Log}X^8$$

Where,

$Y$ = Yield gap between the better practice farmers plot and average practice farmers plot.
$X_1$ = FYM (Kg)
$X_2$ = Urea (kg)
$X_3$ = TSP (Kg)
$X_4$ = MP (kg)
$X_5$ = Irrigation (Tk)
$X_6$ = Insecticide (Tk)
$X_7$ = Human labour (Tk)
$X_8$ = Draft power (Tk) $b_1$............$b_8$ = Co-efficient of the respective variables.

**Limitations**

Qualitative production factors, such as spacing, date and time of different cultural operations might have a great impact on the variation to the yield gap, but these factors could not be included in the model.

## Results and Discussions

**Agronomic practices and technology employed**

It was observed from the study that there were differences in agronomic practices as well as input use levels between BPFP and APFP. Better practiced plots received more amount of chemical fertilizer, Urea 480 kg/ha, TSP 530 kg/ha and MP 290 kg/ha than that of average practiced plots e.g. urea-440 kg/ha, TSP 420 kg/ha and MP 190 kg/ha. On the other hand better practice farmers used 8.9 t/ha cowdung but average practice farmers used 10 t/ha. Farmers did not use fertilizer rationally and it might be due to lack of proper knowledge and cash. Better practiced farmers were found to use more amount of fertilizer and this might be caused higher yield.

**Cost of cultivation**

The cost item was included as human labour, draft power, seed, fertilizer, cowdung, irrigation and insecticide used. It was found that average TVC was Tk.71197/ha for BPFP and it was Tk.72372 for APFP. It was observed that the average TVC was higher in APFP than BPFP due to improper management of average practice farmers plot.

**Economic Returns of Potato cultivation**

It has been seen from Table that the yield was found 15.49 t/ha for BPFP and it was 11.27 t/ha for APFP. The average market price of potato was calculated as Tk.7.5/kg. The gross return was found Tk.116175/ha for BPFP and which Tk.72372/ha for APFP. The gross margin was calculated at Tk.44978/ha for BPFP and it was Tk12,153/ha for APFP. The benefit cost ratio was found 1.63 for BPFP and 1.16 for APFP.

**Yield and Benefit gap**

It was found from Table 1 that the yield differences was 4220kg/ha between BPFP and APFP. The main causes of yield differences were that the farmers did not apply recommended dose of fertilizer, cultural management was not proper. The variable cost was differences as Tk.1175/ha between situation resulting the gross margin gap was found Tk.32825/ha between two management practices.

**Contribution of key factors to the yield gap of potato**

The Cobb-Douglass production function estimated the relative contribution of key factors in yield gap, which is presented in Table 4. The relative contribution of specified factors influencing yield gap can be explained from the estimates of regression equation.

The coefficient of gap in use of urea was found.0.326 implying that one percent increase in urea by APFP, keeping other factors constant, would decrease the yield gap by0.326 percent. Similarly the coefficient of gap in use of TSP, MP and draft power cost was found 0.133, 0.364 and 0.428 respectively, implying that one percent increase in use of TSP,MP and draft power cost ,would decrease the yield gap by 0.133, 0.364 and 0.428 percent, keeping other factors constant.

It was found that the coefficient of multiple determinations, $R^2$ is 0.681 which means that the explanatory variable included in the model explained 68% of the variation in the yield gap. The relative contribution of specified factors influencing yield gap can be seen from the estimates of regression equation (Table 4).

The Elasticity of coefficient (Ebi) was found 0.592 means that the production function exhibits decreasing returns to scale, it means if all the inputs specified in the functions are increased by 1%, yield would have increased by 0.592 percent (Table 4).

The above mentioned results and discussions revealed that the production of potato can be increased by following recommended practices and yield gap can be minimized. It was found that urea, TSP, MP and cost of draft power played significant role in yield gap of potato cultivation. As a result the yield level of APFP can be increased by increasing use of urea, TSP, MP and draft power cost.

**Recommendation**

It is suggested to the farmers based on the findings of the study that in order to enhance yields, they should increase the use of Urea, TSP and MP and decrease the use of human labour.

Table1. Level of technology employed, input used and yield obtained of potato cultivation under different management practices at Bandarban Sadar, during 2002-03

| Management factor | Better practiced farmers plot | Average practiced farmers plots |
|---|---|---|
| Variety | Local (Dohajari) | Local (Dohajari) |
| Number of ploughing | 3-4 | 3-4 |
| Date of sowing | 1st week , Nov. | 2nd & 3rd Week, Nov. |
| Seed rate (kg/ha) | 1578.66 | 1497.06 |
| Fertilizer used (kg/ha): | | |
| Urea : | 480 | 440 |
| TSP: | 530 | 420 |
| MP: | 290 | 190 |
| Cowdung (t/ha) | 8.9 | 10.0 |
| Number of irrigation | 3-4 | 3-4 |
| Time of harvest | Last week Jan-Feb. | Last week Jan-Feb. |
| Yield (ton/ha) | 15.49 | 11.27 |

Table 2. Difference in average levels of variable costs per hectare between BPFP and APFP of potato cultivation at Hill Valleys in Bandarban Sadar, during 2002-03

| Cost items | BPFP | APFP | % of total | | Differences |
|---|---|---|---|---|---|
| | | | BPFP | APFP | BPFP-APFP |
| Human labour (Tk): | | | | | |
| Owned | 20370 | 21200 | 41.39 | 43.16 | - 1766 |
| Hired | 9102 | 10038 | | | |
| Sub-total: | 29472 | 31238 | | | |
| Draft power(Tk): | | | | | |
| Owned | 4330 | 4001 | 9.41 | 8.48 | 559 |
| Hired | 2370 | 2140 | | | |
| Sub-total: | 6700 | 6141 | | | |
| Seed(Tk): | | | | | |
| Owned | 5800 | 6510 | 16.62 | 15.51 | 612 |
| Hired | 6040 | 4718 | | | |
| Sub-total: | 11840 | 11228 | | | |

Table 2. Contd.

| Cost items | BPFP | APFP | % of total | | Differences |
|---|---|---|---|---|---|
| | | | BPFP | APFP | BPFP-APFP |
| Fertilizer(Tk): | | | | | |
| Urea | 3075 | 2811 | 4.97 | 3.88 | 264 |
| TSP | 7390 | 7552 | 10.37 | 10.43 | -162 |
| MP | 2855 | 2505 | 4.07 | 3.46 | 350 |
| Sub-total | 13320 | 12868 | 18.70 | 17.78 | |
| Cowdung(Tk): | | | | | |
| Owned | 2105 | 3562 | 6.04 | 7.82 | -1357 |
| Hired | 2200 | 2100 | | | |
| Sub-total: | 4305 | 5662 | | | |
| Insecticide (Tk) | 972 | 831 | 1.36 | 1.14 | |
| Irrigation(Tk) | 4588 | 4404 | 6.44 | 6.08 | |
| Total variable cost (Tk) | 71,197.0 | 72,372.0 | | | |

Table 3. Situation wise average yield, yield gap, benefit and benefit gap per hectare of potato production under different management practices

| Items | Situation | |
|---|---|---|
| | BPFP | APFP |
| Yield (kg/ha) | 15490 | 11270 |
| Market price @ Tk. 7.5/kg | 7.5 | 7.5 |
| Gross return (Tk./ha) | 1,16,175.00 | 84525.00 |
| Total variable cost (Tk./ha) | 71,197.00 | 72372.00 |
| Gross margin (Tk./ha) | 44,978.00 | 12,153.00 |
| BCR | 1.63 | 1.16 |
| Yield gap (kg/ha) | 4220 (27%) | |
| Gap in gross margin(Tk/ha) | 32,825.00 (72%) | |
| Gap in variable cost(Tk/ha) | 1175.00 8%) | |

Table 4. Cobb-Douglas production function model estimate of determinants of yield gap in potato production in Bandarban district 2002-03

| Explanatory variables and output | BPFP | APFP | Gap between BPFP &APFP | Coefficients of determination |
|---|---|---|---|---|
| Yield (kg/ha) | 15490 | 11270 | 4220 | - |
| Intercept | | | | 2581 |
| $X_1$ =FYM (kg/ha) | 8900 | 10000 | -1100 | -0.383 |
| $X_2$ =Urea(kg/ha) | 480 | 440 | 40 | 0.326 |
| $X_3$ =TSP(kg/ha) | 530 | 420 | 110 | 0.133* |
| $X_4$ =MP(kg) | 290 | 190 | 100 | 0.364** |
| $X_5$ =Irrigation(Tk/ha) | 4588.00 | 4404.00 | 184.00 | -0.173 |
| $X_6$ =Insecticide(Tk/ha) | 972.00 | 831.00 | 141.00 | 0.078 |
| $X_7$=Human labour(Tk/ha) | 29472.00 | 31238.00 | -1766 | -0.181 |
| $X_8$=Draft power(Tk/ha) | 6700.00 | 6141.00 | 559.00 | 0.428* |
| $R^2$ | | | | 0.681 |
| E bi | | | | 0.592 |
| F- statistics | | | | 1.59 |
| No. of observation | | | | 20 |

* denoted 1% level of significance
** refers to 5% level of significance

# YIELD GAP ANALYSIS OF WHEAT UNDER DIFFERENT MANAGEMENT SITUATION AT FSRD SITE, GOYESHPUR, PABNA


## Abstract

The study was carried out at Farming Systems Research and Development (FSRD) site, Goyeshpur, Pabna to estimate the yield and benefit gap under different management practices of Wheat (Var. Kanchan) cultivation during April-May 2003. The study revealed that better practiced farmers plots (BPFP) gave higher yield (2.70 t $ha^{-1}$) than the average practiced farmers plots (APFP) (1.73 t $ha^{-1}$). The yield gap between BPFP and APFP was found 972 kg $ha^{-1}$ (56%) and that of benefit gap (gross margin) was found Tk. 5178.00 $ha^{-1}$ (83%). Using Cobb-Douglas production function model, it was estimated that urea, TSP and human labour played statistically significant role in yield gap between BPFP and APFP. The study suggested that the difference in yield and benefit could be minimized at farm level to increase the use of urea, TSP fertilizers and human labour in the APFP.


## Introduction

Wheat is the second cereal crop in Bangladesh. It can play a vital role in food requirement in the national perspective. Production area of Wheat is increasing day by day but the yield of Wheat does not increase in the same rate. The national average yield of Wheat was 2.27 t/ha in 1997-98 and 2.19 t/ha in 1998-99 (BBS, 1999). In the farmers fields the production efficiency of Wheat, like other crops is not satisfactory in the country. Varietal performance varied significantly from research station to farmers' field. Because the factors of production, both quality and quantity, are not maintained properly in the farmers' level. Amount and quality of different inputs used, sowing or planting time, intercultural operations etc. varied from research station to farmers' practice and also varied among the farmers cultivating Wheat. These might be the causes of such yield differences. In Bangladesh, most of the farmers cultivate Kanchan variety of Wheat with traditional management practices resulting low average yield. The farmers do not follow the recommended practices. But there are some farmers whose management is better compared to the average farmers and thus they obtain better yield. In order to increase the production of Wheat to its maximum possible extent at farm level, it is necessary to identify the factors behind this yield gaps. The study is, therefore, designed to estimate the yield and benefit differences of Wheat under different management practices and to identify the factors behind yield differences of Wheat under different management practices.

## Materials and Methods

The study was carried out at Farming Systems Research and Development (FSRD) site, Goyeshpur, Pabna to estimate the differences in yield and benefit of Wheat under different management practices. The farmers' management practices were classified into two groups. The first group consists of better-practiced 50 percent farmers (better practiced farmers' plot-BPFP) who got comparatively higher yield and the rest 50 percent were the average practiced farmers' plots (APFP). A total of 50 plots of 50 farmers with Wheat were selected randomly to collect primary data. After collection of primary data the whole set were classified into above-mentioned two groups. Data for the study were collected during April-May 2003 through survey method by using a pre-tested schedule.

A Cobb- Douglas production function was selected to quantify the relative contribution of different production factors to the yield gap between BPFP and APFP for being easy on logarithmic transformation. The function becomes a simple linear one and the co-efficient of the production factors are the elasticity of production.

The Cobb- Douglas functional form of the multiple regressions is as follows:

$Y = a\ Xi\ Ui$

or, $\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + Ui$

Where,

Y = Yield gap between better practiced farmers plot (BPFP) and average practiced farmers plot (APFP) (Kg/ha)

$X_1$= Difference in Urea (kg/ha)

$X_2$= Difference in TSP (kg/ha)

$X_3$= Difference in MP (kg/ha)

$X_4$= Difference in Gypsum (kg/ha)

$X_5$ = Difference in Human labor (Tk/ha)

$X_6$ = Difference in Mechanical power (Tk/ha)

a = Constant or intercept, $b_1, b_2, b_3$, ----,$b_6$ = Co efficient of respective variables and

Ui= Disturbance term

## Results and Discussion

### Agronomic practices and technology employed

It is evident from the study that there were differences in agronomic practices as well as input use levels between BPFP and APFP. Better practiced plots received more amount of chemical fertilizer (162-121-36-75 kg Urea-TSP-MP-Gypsum ha$^{-1}$) than that of average practiced plots (151-92-45-0 kg Urea-TSP-MP-Gypsum ha$^{-1}$) (Table-1). Sowing period also differed. Farmers did not use fertilizer rationally and it might be due to lack of proper knowledge and cash. Better practiced farmers were found to use more amounts of chemical fertilizers and this might be caused higher yield. It is observed that BPFP produced higher yield (2.7 t/ha) than that of APFP (1.73 t/ha). The yield gap was 972 kg/ha. It was found that farmers applied less amount of fertilizer (162-121-36-75 kg/ha urea-TSP-MP-Gypsum) than that of recommendation (180-140-40-110-9.6-7.5 kg/ha Urea-TSP-MP-Gypsum-Zinc-Borax) (BARC, 1997). This wide gap in fertilizer use might be the cause of such yield gap. It was observed that any of the farmers group do not used recommended dose of fertilizer but better practiced farmers were closer to the recommended dose of fertilizer.

### Cost of cultivation

In case of BPFP and APFP the average total cost was found Tk 13555.00 and Tk 9591.00 respectively. The higher cost incurred in Wheat cultivation under better practiced plots compared to average farmers' practices was mainly due to higher use of material inputs and improved management practices (Table-2). The better-practiced farmers' plots obtained higher gross margin (Tk11393.00) than average practiced farmers' plots (Tk. 6215.00). It noticed that 41% gap in total cost caused 56% gap in grain yield and 83% gap in gross margin. It indicates that the cost incurred at average practiced farmers' plot was not nation and provides less return to the farmers.

### Contribution of key factors to the yield gap of Wheat

The Cobb-Douglas production function estimated the relative contribution of key factors in yield gap, which is presented in Table 3. The relative contribution of specified factors influencing yield gap can be explained from the estimates of regression equation.

The coefficient of gap in use of Urea was found 0.291 implying that one percent increase in urea by APFP, keeping other factors constant, would decrease the yield gap by 0.291 percent. Similarly the coefficient of gap in use of TSP and human labour was found 0.383 and 0.217 respectively, implying that one percent increase in use of TSP by APFP, keeping other factors constant, would decrease the yield gap by 0.383 percent and one percent increase in human labour by APFP, keeping other factors constant, would decrease the yield gap by 0.217 percent (Table-3).

The co-efficient of multiple determinations $R^2$ was found 0.72 implying that the explanatory variables included in the model explained 72% of the variation in the yield gap of Wheat. The summation of all production co-efficient (**Σ** bi) was found 0.61, means that the production function exhibits decreasing returns to scale. It means if all the inputs specified in the function are increased by 1 percent, yield would have increased 0.61 percent. F value was found 2.79 indicated that all the included explanatory variables are important for explaining the gap in yield of Wheat production (Table 3).

The above-mentioned results and discussions reveal that the production of Wheat can be increased by following recommended practices and yield gap can also be minimized. It was found that urea, TSP and human labour played significant role in yield gap of Wheat production. As a result the yield level of APFP can be increased by increasing use of urea, TSP and human labour. The yield of average practiced farmers' plots can be increased by increasing use of these inputs.

## Reference

BBS. 1999 Statistical Pocket Book of Bangladesh, Statistics Division, Ministry of Planning, Govt. of the People's Republic of Bangladesh.

BARC. 1997. Fertilizer Recommendation Guide-1997. Bangladesh Agricultural Research Council, Farmgate, Dhaka.

Razzaque, M. A. e*t al* (1999). Hand Book of Agricultural Technologies, BARI, Joydebpur, Gazipur.

Table 1. Level of technology employed and yield obtained in Wheat cultivation under different management practices at Goyeshpur, Pabna during 2002-03

| Sl. no | Management factor | Situations | |
|---|---|---|---|
| | | Better practiced farmers' plots | Average practiced farmers' plots |
| 01 | Variety | Kanchan | Kanchan |
| 02 | Human labour (man-days) | 90 | 52.5 |
| 03 | No. of ploughing | 2-3 | 2-3 |
| 04 | Sowing period | 30 Nov.-16 Dec. | 3-22 Dec. |
| 05 | Seed rate (kg $ha^{-1}$) | 150 | 138.75 |
| 06 | Fertilizer used (kg $ha^{-1}$): | | |
| | Total (Urea-TSP-MP-Gyp) | 162-121-36-75 | 151-92-45-0 |
| 07 | Irrigation (times) | 1-2 | 1 |
| 08 | Harvesting time | 28 March-3 April | 2-7 April |
| 09 | Yield (kg $ha^{-1}$): | | |
| | Grain | 2700 | 1728 |
| | Straw | 2645 | 1372 |
| Gap in grain yield (kg) | | 972 (56%) | |

Table 2. Difference in average level of variable costs per hectare between BPFP and APFP of Wheat cultivation at Goyeshpur, Pabna 2002-03

(Tk/ha)

| Items | BPFP | APFP | Difference |
|---|---|---|---|
| | | | BPFP-APFP |
| Mechanical power | 1800 | 1290 | 510 |
| Human labour | 6300 | 3675 | 2625 |
| Seed | 2100 | 1943 | 157 |
| Fertilizer: | | | |
| Urea | 1013 | 944 | 295 |
| TSP | 1755 | 1334 | 1160 |
| MP | 324 | 405 | -108 |
| Gypsum | 263 | - | 263 |
| Total cost | 13555 | 9591 | 3964 (41%) |
| Main product | 23625 | 15120 | 8505 (56%) |
| By- product | 1323 | 686 | 637 |
| Gross return | 24948 | 15806 | 9142 |
| Gross margin | 11393 | 6215 | 5178 (83%) |

BPFP = Better practiced farmers plot, APFP = Average practiced farmers plot

Table 3. Cobb-Douglas production function model estimate of determinants of yield gap in Wheat cultivation at Goyeshpur, Pabna during 2002-03

| Variable | Co-efficient of determination |
|---|---|
| Intercept | 9.32 |
| $X_1$ Human labour (Man-days) | 0.217* (0.182) |
| $X_2$ = Mechanical power (Tk) | 0.311 (0.819) |
| $X_3$ = Urea (kg) | 0.291* (0.135) |
| $X_4$ = TSP (kg) | 0.383** (0.371) |
| $X_5$ = MP (kg) | 0.236 (0.151) |
| $X_6$ = Gypsum (kg) | 0.192 (0.286) |
| $R^2$ | 0.72 |
| F-statistics | 2.79 |
| Return to scale ($\sum$ bi) | 0.61 |
| No. of observation | 50 |

Figures in the parenthesis indicate standard error of mean

** Significant at 1% level, * Significant at 5% level.

# FERTILIZER MANAGEMENT IN MAJOR CROPPING PATTERNS AT JESSORE AND PANCHAGARH DISTRICT


## Abstract

The study was carried out at Multilocation Testing (MLT) Site Bagherpara, Jessore and Panchagarh, Dinajpur to identify the existing fertilizer management practices in major cropping patterns during January-March 2003. Boro-T.Aman, Mustard-Jute-T.Aman and Wheat-Fallow-T.Aman cropping pattern were identified as three major cropping patterns at Jessore whereas Boro-T.Aman, Wheat-Fallow-T.Aman and Potato-Jute-Fallow were identified as three major cropping patterns at Panchagarh. The study revealed that farmers do not apply recommended dose of fertilizer to their crop field. No general trend was found for using inorganic fertilizer to the crops. The amount of fertilizers varied among the crops but the recommendation was not followed in most of the cases.


## Introduction

The rice-rice cropping systems with unbalanced use of inorganic fertilizer have deleterious effects on soil health. Application of fertilizers especially NPK, in balanced quantities is often advocated for sustaining high yields of crops (Bhuiyan *et al.*, 1991; Singh *et al.* 1973). In intensive rice cultivation with high yielding varieties, however, phosphate and potash application may be needed along with nitrogen for satisfactory rice yields. With the gradual spread of high yielding varieties (HYVs) of different crops in Bangladesh, it is necessary to assess the contribution of fertilizer elements to the grain yield of the crops. Among the factors that affect crop production, fertilizer is the single most important one that plays a crucial role in yield increased. Of the total nutrients used in the soil, nitrogen alone constitutes about 80 percent, which may lead to nutrient imbalance in soil-plant systems.

Significant carry over effects of different chemical fertilizers was observed in different studies (Balla, 1974; Gupta *et al.*, 1986). The first task for this purpose is to identify present fertilizer management practices in major cropping patterns. The study is, therefore, undertaken to identify the existing fertilizer management practices in major cropping patterns.

## Methodology

The study was conducted at MLT site Jessore and Panchagarh. A total of 50 farmers at both locations were selected using simple random sampling technique for primary data collection. The survey was conducted with the help of a pre-designed schedule by direct interviewing the selected farmers. The collected information was edited, summarized and local units and measurements were converted into standard ones. The results were presented in tabular form.

## Results and Discussions

### Fertilizer management and crop performance

Organic manure like farmyard manure (FYM) was found to use in all major cropping patterns. Farmyard manure was applied in all the three first crops of the cropping patterns at Jessore. T.Aman did not receive any kind of organic manure when it is sequenced with either Boro, Wheat or Mustard (Table 1). The inorganic (NPKS) dressing as basal dose with Boro was 0-23-28-15 kg/ha in the Boro-Fallow-T.Aman cropping pattern. Top dressing of nitrogen @ 51 kg/ha was done for Boro in first installment, whereas 38 kg N/ha was applied in the second installment (Table 1). Farmers used higher amount of NPKS in T.Aman of Boro-T.Aman cropping pattern (Table 2). The farmers did not apply any Zn for Boro though it was recommended 1.50 kg/ha. In the Mustard-Jute-T.Aman cropping pattern, Mustard received 34-8-13-10 kg/ha NPKS against a recommendation of 70-15-17-13 kg/ha

NPKS. The other crop of the pattern, T.Aman received 84-18-25-16 kg/ha NPKS against a recommendation of 45-4-15-2 kg/ha NPKS (Table 2). In Wheat-T.Aman cropping pattern, Wheat received 65-16-20-13 kg/ha NPKS against a recommendation of 40-20-35-10-2-0.5 kg/ha NPKSZnB. Farmers use more amount of PKS in T.Aman of Boro-T.Aman and mustard-jute-T.Aman cropping pattern against recommendation. Farmers were found to apply no zinc fertilizers in any of the crops in the three major cropping patterns. Farmers received satisfactory level of yield of T.Aman in all the cropping patterns. But yield level of Mustard, Jute and Wheat was found lower compared to recommended yield.

In Panchagarh, farmers used cowdung in all the first crops of the cropping pattern and also in Jute in Potato-Jute cropping pattern (Table 3). They use 28 kg/ha P during top dress in potato crops of Potato-Jute-Fallow cropping pattern. Farmers did not used N in Potato-Jute cropping pattern in the 2$^{nd}$ top dressing. They received satisfactory level of yield from the three major cropping patterns except Wheat crop. Irrespective of cropping patterns, the amount of P and S used by the farmers was higher than that of recommendation. But farmers used less amount of other fertilizers except N in Boro and T.Aman of Boro-T.Aman cropping pattern and Potato crops in Potato-Jute cropping pattern (Table 4).

### Trend of crop yield

Crop production status was reported to be stable by the 26 percent farmers at Jessore and 20 percent farmers at Panchagarh as because traditional cultivation, use of balanced fertilizers and regulars intercultural operation. Increasing trend of crop production was reported by the 56 percent farmers at Jessore and 64 percent farmers at Panchagarh due to the use of organic and inorganic fertilizer, modern variety and production technology, training and extension services as well as maintaining crop rotation. Decreasing crop production was reported by the 18 percent farmers of Jessore and 16 percent farmers of Panchagarh for not or less using of organic manure, flood, lack of quality seeds and decreasing soil fertility (Table 5).

## Conclusion

Farmers do not apply recommended dose of fertilizer to their crop field. No general trend was found for using inorganic fertilizer to the crops. The amount of fertilizers varied among the crops but the recommendation was not followed in most of the cases. The farmers were found to apply higher amount of P in all the T.Aman crops of the major cropping pattern. But application of other fertilizers was less than recommendation. The unbalanced use of all the nutrients may lead to nutrient imbalance in soil plant systems and yield goal could not be achieved in most cases. Use of organic manure is negligible which may lead to a degradation of soil nutrient status. In order to enhance yield accurate dose of organic and inorganic fertilizer would be applied, improved variety should be adopted and extension service should be strengthened.

### References

Balla, H. 1974. The value of residual fertilizer NPK and phosphorus in a long-term experiment. Soils and Ferts. Abst. 38:292.

Bhuiyan N I, A L Shah and G M Panaullah. 1991. Effect of NPK fertilization on the grain yield of transplanted rice and soil fertility-A long-term study. Bangladesh J soil Sci. 22 (1&2): 41-49.

Table 1. Agronomic performance of major cropping pattern at MLT site Bagherpara, Jessore

| Item | Cropping pattern-I | | Cropping pattern-II | | | Cropping pattern-III | |
|---|---|---|---|---|---|---|---|
| | Boro | T.Aman | Mustard | Jute | T.Aman | Wheat | T.Aman |
| Variety used | BR-26 | BR-11 | Local, Tori-7 | Tossa | BRRIDhan33 | Kanchan | BR-11 |
| Sowing time | 15 Jan. | 15 July-15 Aug. | 10-30 Nov. | 15-30 March | 30 July-15 Aug. | 15 Nov.-10 Dec. | 15 July-7 Aug. |
| Organic Manure (kg/ha) | 1098 | - | 800 | 1733 | - | 4340 | - |
| Basal Fertilizer (kg/ha) | | | | | | | |
| N | - | - | - | - | - | - | - |
| P | 23 | 20 | 8 | 13 | 21 | 16 | 24 |
| K | 28 | 24 | 13 | 16 | 25 | 20 | 19 |
| S | 15 | 18 | 10 | 8 | 16 | 13 | 21 |
| 1st TD of N | 51 | 43 | 34 | 31 | 45 | 41 | 37 |
| 2nd TD of N | 38 | 29 | - | - | 39 | 24 | 31 |
| Harvesting period | 1-15 April | 15-30 Nov. | 1-15 Feb. | 30 July - 10 Aug. | 1-25 Nov. | 15-30 Mar. | 15 Nov. - 10 Dec. |
| Grain yield (kg/ha) | 5400 | 3734 | 639 | 2634 | 3400 | 3040 | 4268 |
| By product (kg/ha) | 3400 | 4539 | 731 | 5928 | 4123 | 3548 | 2308 |

TD = Top dressing

Table 2. Nutrient application and productivity of the crops as compared to recommendation at MLT site Bagherpara, Jessore

| Practice | Nutrients (kg/ha) | | | | | | Yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | Zn | B | Main product | By product |
| **Boro-T.Aman cropping pattern** | | | | | | | | |
| Boro | | | | | | | | |
| FP | 89 | 23 | 28 | 15 | - | - | 5400 | 3400 |
| Recom. | 100 | 20 | 35 | 10 | 1.5 | 1.5 | 4500 | - |
| T.Aman: | | | | | | | | |
| FP | 72 | 20 | 24 | 18 | - | - | 3734 | 4539 |
| Recom. | 70 | 8 | 20 | 4 | - | - | 3500 | - |
| **Mustard-Jute-T.Aman cropping pattern** | | | | | | | | |
| Mustard: | | | | | | | | |
| FP | 34 | 8 | 13 | 10 | - | - | 639 | 1731 |
| Recom. | 70 | 15 | 17 | 13 | 1 | 0.5 | 1200 | - |
| Jute: | | | | | | | | |
| FP | 31 | 13 | 16 | 8 | - | - | 2634 | 5928 |
| Recom. | 65 | 7 | 20 | 4 | - | - | 3000 | - |
| T.Aman : | | | | | | | | |
| FP | 84 | 18 | 25 | 16 | - | - | 3400 | 4123 |
| Recom. | 45 | 4 | 15 | 2 | - | - | 2400 | - |
| **Wheat-T.Aman cropping pattern** | | | | | | | | |
| Wheat: | | | | | | | | |
| FP | 65 | 16 | 20 | 13 | - | - | 3040 | 3548 |
| Recom. | 40 | 20 | 35 | 10 | 2 | 0.5 | 3500 | - |
| T.Aman : | | | | | | | | |
| FP | 68 | 24 | 19 | 21 | - | - | 4268 | 5308 |
| Recom. | 70 | 6 | 20 | 4 | - | - | 3500 | - |

FP = Farmers practice, Recom. = Recommendation

Table 3. Agronomic performance of major cropping pattern at MLT site Panchagarh, Dinajpur

| Item | Cropping pattern-I | | Cropping pattern-II | | Cropping pattern-III | |
|---|---|---|---|---|---|---|
| | Boro | T.Aman | Wheat | T.Aman | Potato | Jute |
| Variety used | BRRI Dhan 28 | BR-11 | Kanchan | BR-28 | Cardinal | Tossa |
| Sowing time | 6-12 Feb. | 5-30 July | 30 Nov.- 20 Dec. | 10-25 July | 10-20 Nov. | 22 Mar.- 18 April |
| Organic Manure (kg/ha) | 3055 | - | 2470 | - | 3529 | 1976 |
| Basal Fertilizer (kg/ha) | | | | | | |
| N | 32 | - | - | - | 73 | - |
| P | 18 | 14 | 23 | 15 | 40 | 16 |
| K | 27 | 20 | 34 | 17 | 71 | 18 |
| S | 10 | 8 | 13 | 6 | 15 | 18 |
| 1st TD of N | 48 | 64 | 67 | 32 | 63 28 (P) | 54 |
| 2nd TD of N | 31 | 18 | 17 | 21 | - | - |
| Harvesting period | May 20 June 6 | Nov. 6-23 | March25 April 10 | Nov.19 – Dec.15 | Feb 10-28 | July 16-Aug 5 |
| Grain yield (kg/ha) | 4916 | 3582 | 2395 | 3555 | 18381 | 2706 |
| By product (kg/ha) | 5821 | 5248 | 4322 | 5487 | - | 4940 |

Table 4. Nutrient application and productivity of the crops as compared to recommendation at MLT site Panchagarh, Dinajpur

| Practice | Nutrients (kg/ha) | | | | | | Yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| | N | P | K | S | Zn | B | Main product | By product |
| **Boro-T.Aman cropping pattern** | | | | | | | | |
| Boro: | | | | | | | | |
| FP | 111 | 18 | 27 | 10 | - | - | 4916 | 5821 |
| Recom. | 100 | 15 | 45 | 8 | 1.5 | - | 4500 | - |
| T.Aman: | | | | | | | | |
| FP | 82 | 14 | 20 | 8 | - | - | 3582 | 5248 |
| Recom. | 75 | 10 | 35 | 4 | - | - | 3500 | - |
| **Wheat-T.Aman cropping pattern** | | | | | | | | |
| Wheat: | | | | | | | | |
| FP | 84 | 23 | 34 | 13 | - | - | 2395 | 4322 |
| Recom. | 90 | 20 | 15 | 15 | 2 | 0.5 | 3500 | - |
| T.Aman: | | | | | | | | |
| FP | 55 | 15 | 17 | 6 | - | - | 3555 | 5487 |
| Recom. | 75 | 10 | 35 | 4 | - | - | 3500 | - |
| **Potato-Jute cropping pattern** | | | | | | | | |
| Potato: | | | | | | | | |
| FP | 136 | 68 | 71 | 16 | - | - | 18381 | - |
| Recom. | 100 | 20 | 80 | 10 | - | - | 20000 | - |
| Jute: | | | | | | | | |
| FP | 54 | 16 | 18 | 5 | - | - | 2706 | 4940 |
| Recom. | 60 | 8 | 30 | 5 | - | - | 3000 | - |

FP = Farmers practice, Recom. = Recommendation

Table 5. Trend of crop yield during last 5 years as reported by the farmers at MLT site, Bagherpara, Jessore and Panchagarh, Dinajpur

| Yield status | Farmers responded (%) | | Reasons |
|---|---|---|---|
| | Jessore | Panchagarh | |
| Stable | 26 | 20 | Traditional cultivation and fertilizer use and regular intercultural operation. |
| Increasing | 56 | 64 | Organic and inorganic fertilizer use, regular intercultural operation, maintaining crop rotation, modern variety and production technology, training and extension service. |
| Decreasing | 18 | 16 | No or less use of organic manure, decreasing soil fertility insect pest infestation and lack of quality seed. |

# TECHNOLOGY TRANSFER

## a. Crops

| Title | Location | Area (ha)/plant | Farmers involved (no.) | Yield (t/ha) | Impact |
|---|---|---|---|---|---|
| **A. Oil seeds** | | | | | |
| Mustard (var. BARI Sharisha-9) | Narikeli, Jamalpur | 0.42 | 6 | 1.45 | Farmer are interested to grow BARI Sharisha 8/9 |
| **B. Pulses** | | | | | |
| Chickpea (var.BARI Chola-2) | Chabbishnagar | 2.0 | - | 1.26 | |
| Chickpea (var.BARI Chola-5) | Nachole, Barind | 3.0 | - | 1.20 | |
| **C. Wheat** | | | | | |
| Wheat (var. Protiva) | Chabbisnagar | 0.5 | 4 | 3.38 | Shatabdi is recommend for large scale production |
| Wheat (var. Satabdi) | Chabbisnagar | 1.5 | 4 | 2.78 | |
| **E. Vegetables** | | | | | |
| Country bean (BARI shim-1) | Narikeli, Jamalpur | 0.25 | 32 | 13.6 | Recommended for large scale production |
| Lady's finger (BARI Derosh-1) | Narikeli | 0.31 | 23 | 11.5 | Large scale extension programme |
| **F. Root crops** | | | | | |
| Kachu (Latiraj) | Narikeli, Jamalpur | 0.95 | 9 | 15.28 | Good market value & accept as good vegetable by the farms |
| **b. Composting with kitchen and farmer waste** | Narikeli<br>Lebukhali<br>Kalapara<br>Borguna | 13(heep) | 13<br>20<br>15<br>10 | Compost 621 kg/hap | Use in homestead garden |
| **c. Seed exchange program** | | | | | |
| Mustard (BARI Sharisha 9) | Barind, Rajshahi | 8.0 | 40 | 1.10 | |
| Chickpea | " | 9 | 60 | 1..22 | |
| Wheat | " | 2 | 10 | 2.85 | |
| **d. Crop Museum** | | | | | |
| Wheat | | | | | |
| Var. Barkat | Chabbishnagar | 10x10 m | | 2.63 | |
| Var. Protiva | Chabbishnagar | " | - | 3.33 | |
| Var. Kanchan | Chabbishnagar | " | - | 3.18 | |
| Var. Inkilab | Chabbishnagar | " | - | 3.0 | |
| Var. Gourav | Chabbishnagar | " | - | 3.25 | |
| Var. Akbar | Chabbishnagar | " | - | 2.43 | |
| Var. Shatabdi | Chabbishnagar | " | - | 2.98 | |
| **Chickpea** | | | | | |
| Deshi Chola | Chabbishnagar | " | - | 0.98 | |
| BARI Chola 5 | Chabbishnagar | " | - | 1.15 | |
| BARI Chola 3 | Chabbishnagar | " | - | 1.00 | |
| BARI Chola 4 | Chabbishnagar | " | - | 0.95 | |
| BARI Chola 2 | Chabbishnagar | " | - | 1.20 | |
| Nabin | Chabbishnagar | " | - | 1.05 | |
| Aniggeri | Chabbishnagar | " | - | 1.25 | |

| | | | | |
|---|---|---|---|---|
| **Barley** | | | | |
| BARI Barley 1 | Chabbishnagar | : | - | 2.45 |
| BARI barley 2 | " | - | - | 2.35 |
| Local | Chabbishnagar | " | - | 1.96 |
| Cheena | Chabbishnagar | " | - | 1.00 |
| Kaon | Chabbishnagar | " | - | 0.98 |
| Sesame | Chabbishnagar | " | - | 0.68 |
| Niger | Chabbishnagar | " | - | 0.99 |
| Linseed | Chabbishnagar | " | - | 1.00 |
| Sunflower | Chabbishnagar | " | - | 1.15 |

## e. Livestock

| Date of vaccination | Name of the vaccine | Number of bird vaccinated | Mortality rate before vaccination (%) | Mortality rate after vaccination (%) | Causes of death after vaccination |
|---|---|---|---|---|---|
| 15.6.02 to | BCRDV | 465 | 95 | 10 | Predator animal bacterial & parasitic diseases |
| 30.4.02 | RDV | 1056 | 78 | 5 | Economically viable & profitable |
| Total | 1521 | | | | |

## Development Program, 2002-03
## OFRD, BARI, Bandarban

| Sl.no. | Name of technology | No. of farmer | Area covered (ha) | Av. yield (ton/ha) | Output Impact/Farmers feedback |
|---|---|---|---|---|---|
| **A.** | **Creeper crops** | | | | |
| | BARI Lau-1 | 39 | 112 pit | 35.5 | Farmers appreciated its due to early and more fruiting with higher yield compare to local variety. |
| | BARI Seem-1 | 30 | 128 pit | 18.3 | Farmers appreciated BARI Seem-1 due to higher yield and softness as well as delicious to eat and market demand is high due to its attractiveness of colour than local one. |
| | BARI Seem-2 | 15 | 65 pit | 8.5 | |
| **B.** | **Vegetables** | | | | |
| | BARI Tomato: Var.<br>a. Ratan<br>b. Manik<br>c. BARI Tomato-8<br>d. BARI Tomato-12 | 4 | 0.16 | 53.5(av.)<br>65.4<br>45.3<br>49.2<br>54.1 | Among the three varieties the yield performance of Ratan was good and farmers are agreed to produce it if the seedling are available there. Bacterial wilting and irrigation facilities were the major problem. |
| | Radish: Var.<br>a. Tasakisan<br>b. Druti<br>c. Pinky | 10 | 0.40 | 35.5<br>38<br>27.3<br>41.2 | Farmers are very much interested to grow Pinky variety due its higher yield and market demand but seeds are not available there. |
| | BARI Begun-1(Uttara) | 5 | 0.60 | 34.2 | Less demand than local one |
| | BARI Data (Laboni) | 25 | 0.20 | - | Excellent acceptance at farmers' level due to higher profit and high market demand. |
| | BARI Dherosh-1 | 10 | 1.0 | - | Farmer acceptance is high but good quality of seeds should be ensured at farmer level. |
| | BARI Latiraj | 4 | 0.12 | - | Farmers are agreed to produce it. |
| **C.** | **Oil crops** | | | | |
| | Groundnut (Dhaka-1) | 2 | 0.12 | 2.5 | Farmers are agreed to mass production if the seeds are available |
| | Mustard (BARI Sarisha-9) | 4 | 0.40 | 0.988 | No demand at farmers level |
| **D.** | **Cereal crops** | | | | |
| | Maize in block demonstration: Var.<br>a. Barnali<br>b. Koi Bhutta<br>c. BARI Hybride-1<br>d. Mohar | 20 | 1.86 | 4.1(av.)<br>4.6<br>3.7<br>5.5<br>2.6 | Farmers are agreed to maize production due to its higher demand in this area. Among this variety yield performance was good in BARI Hybride-1 and farmers are appreciated it. If seed are available farmers will be produced in large scale but irrigation is main problem in dry season. |
| | BARI Kaon (Titas) | 5 | 0.20 | 0.494 | Less demand at farmers level |
| **E.** | **Pulses** | | | | |
| | BARI Mushur-4 | 5 | 0.008 | 0.893 | Do |
| **F.** | **Others** | | | | |
| | BARI Chula-5 | 5 | 0.008 | 1.25 | Farmers are agreed to mass production if the seeds are available |

## Appendix

**List of Scientists involved with On-Farm Research Division (2002-03)**

| Sl no. | Name | Designation | Remarks |
|---|---|---|---|
| 1. | **Head quarter, Joydebpur** | | |
| 2. | Dr. M Matiur Rahman | CSO | Director (Res.) |
| 3. | Dr. M Farid Uddin Mia | CSO | On LPR |
| 4. | Dr. M Abu Sufian | CSO | |
| 5. | Dr. M A Quayyum | PSO | |
| 6. | Dr. M Mustaque Ahmed | SSO | |
| 7. | Dr. M Yusuf Ali | SSO | |
| 8. | Dr. M Mohabbat Ullah | SO | |
| 9. | M Rafiqul Islam | SO | |
| 10. | Dilwar A. Choudhury | SO | |
| 11. | Quamrun-Naher | SO | |
| 12. | M Akhtar Hossain | SO | |
| | **Shippur, Narsinghdi** | | |
| 13. | M Asaduzzaman | SO | Higher study |
| | **Shaympur, Rajshahi** | | |
| 14. | Dr. M Maznur Rahman | PSO (WRC) | |
| | **Barind, Rajshahi** | | |
| 15. | M Shafiqul Islam | SO | |
| 16. | M Abdus Salam | SO | |
| 17. | M Faruque Hossain | SO | |
| | **Pabna** | | |
| 18. | M Abdul Momin | SSO | Higher study |
| 19. | Ferdouse Islam | SO | |
| 20. | M Akkas Ali | SO | Higher study |
| 21. | M Rabiul Alam | SO | |
| 22. | M Shamim Hossain Mollah | SO | |
| 23. | M Obaidul Hoque | SO | |
| | **Bogra** | | |
| 24. | Md. Abdur Rahim | SSO | |
| 25. | Nur-E-Alam Siddique | SO | |
| | **Dinajpur** | | |
| 26. | S M A Jabber | SO | |
| | **Rangpur** | | |
| 27. | M Badirul Islam | SSO | |
| 28. | M Abdul Mannaf | SSO | |
| 29. | M Mohi Uddin | SO | Transfer to HRC |
| 30. | M Al Amin Talukder | SO | |
| 31. | A H M Mostofa Kamal | SO | |
| 32. | Selim Ahmed | SO | |
| 33. | Ashis Kumar | SO | |
| | **Jamalpur** | | |
| 34. | Dr. M Matiur Rahman | SSO | |
| 35. | M Golam Moula | SSO | |
| 36. | M Shamsur Rahman | SO | |
| 37. | M Rajab Ali | SO | |

| Sl no. | Name | Designation | Remarks |
|---|---|---|---|
| | **Tangail** | | |
| 38. | M Mukhlesur Rahman | SSO | |
| 39. | M Jamal Hossain | SO | Higher study |
| 40. | M Aminur Rahman | SO | |
| | **Mymensingh** | | |
| 41. | Dr. S M Asaduzzaman | SSO | |
| 42. | Habib M Naser | SO | Higher study |
| 43. | Nargis Sultana | SO | |
| | **Kishoregonj** | | |
| 44. | M Helim Khan | SO | |
| | **Jessore** | | |
| 45. | M Nur Alam Mondal | SSO | |
| 46. | M Asraf Hossain | SSO | |
| 47. | M Kawser Uddin Ahmed | SO | |
| | **Patuakhali** | | |
| 48. | Sikder Rafiquzzaman | SSO | |
| 49. | M Idris Ali Hawlader | SO | Higher study |
| 50. | M Abdur Razzaque | SO | Higher study |
| 51. | M Shahidul Islam | SO | |
| | **Faridpur** | | |
| 52. | M Serajul Islam | SSO | |
| 53. | M Ruhul Amin | SO | |
| | **Khulna** | | |
| 54. | Sheikh Mostafa Zaman | SSO | |
| | **Kushtia** | | |
| 55. | M Kamrozzaman | SO | |
| 56. | M Alamgir siddiki | SO | Higher study |
| | **Barisal** | | |
| 57. | M Shahidul Islam Khan | SO | |
| | **Hathazari** | | |
| 58. | Parimal C. Sarker | SO | |
| | **Noakhali** | | |
| 59. | A F M Fazlur Rahman | PSO | |
| 60. | Dr. Mohammed Amin | SSO | |
| 61. | Dr. Jasim Uddin | SSO | |
| 62. | M Kamrul Hasan | SO | Higher study |
| | **Sylhet** | | |
| 63. | Apurba K. Choudhury | SO | |
| 64. | Md. Obaidullah Kaisar | SO | |
| | **Comilla** | | |
| 65. | M Safiqul Islam | SSO | |
| 66. | M Muktadir Alam | SO | Higher study |
| | **Khagrachari** | | |
| 67. | Mahmudul Hasan Nazrul | SO | |
| | **Bandarban** | | |
| 68. | M Jamal Uddin | SO | |