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CEREAL SYSTEMS INITIATIVE FOR SOUTH ASIA IN BANGLADESH

ANNUAL REPORT

NOVEMBER 2014

CIMMYT
IRRI
WorldFish

CEREAL SYSTEMS INITIATIVE FOR SOUTH ASIA IN BANGLADESH

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Submitted by

International Rice Research Institute (IRRI), International Maize and Wheat Improvement Center (CIMMYT), and WorldFish

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Acknowledgments

This report is based on contributions from a large number of CSISA-BD staff. The Chief of Party would like to acknowledge the work done by CSISA-BD staff through a year period and the excellent contributions they have made to the preparation of this report

Timothy Russell

Chief of Party, CSISA-BD

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ADO	agriculture/aquaculture development officer
AFP	axial flow pumps
AIN	agricultural input and nutrition
ART	adaptive research trials
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BDS	Bangladesh Development Society
BDT	Bangladeshi taka
BINA	Bangladesh Institute of Nuclear Agriculture
BMS	Bihango Mohila Sangstha
BMT	Bangladesh management team
BRRI	Bangladesh Rice Research Institute
BRAC	Bangladesh Rural Advancement Committee
CA	conservation agriculture
CAF	commercial aquaculture farming
CBO	community-based organization
CDC	collapsible drier case
CIMMYT	International Maize and Wheat Improvement Center
CoP	chief of party
CSISA-BD	Cereal Systems Initiative for South Asia in Bangladesh
CSISA-MI	Cereal Systems Initiative for South Asia Mechanization and Irrigation
DAE	Department of Agricultural Extension
DoF	Department of Fisheries
DQA	Data Quality Assessment
DSR	direct-seeded rice
EU	European Union
FOG	Financial Operations Guideline
FtF	Feed the Future
FY	financial year
GIS	geographic information system
GJUS	Grameen Jano Unnayan Sangstha
HAC	hub administrative coordinator
HDO	horticulture development officer
HH	household
HYV	high-yielding varieties
iDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IR	intermediate results
IRRI	International Rice Research Institute
ISWA	Integrated Social Welfare Association
IWD	International Women's Day
JCF	Jagoroni Chakra Foundation
LE	linkage event

ACRONYMS

LoA	Letters of Agreement
LSP	local service provider
MAS	Mechanization of Agriculture System
M&E	monitoring and evaluation
MYAP	Multiyear Action Plan
NDVI	Normalized difference vegetation index
NGO	nongovernment organization
OSP	orange sweet potato
PFT	participatory farmer trials
PMEP	Project Monitoring and Evaluation Plan
PNGO	partner nongovernment organization
PVC	polyvinyl chloride
PVS	participatory varietal selection
QPM	quality protein maize
RFLDC	Regional Fisheries and Livestock Development Component
SACO	Social Advancement Community Organization
SDC	Society Development Committee
SMSPA	Small and Marginal Seed Producers Associations
SOP	standard operating procedures
SRSPDS	Sustainable Rice Seed Production and Delivery Systems for Southern Bangladesh
ST	strip tillage
STRV	stress-tolerant rice variety
SWSPAB	Southwest Seed Producers Association of Bangladesh
T. aman	transplanted aman rice
TMSS	Thengamara Mohila Sabuj Sangha
ToT	training of trainers
UDP	urea deep placement
USAID	United States Agency for International Development
USG	United States government
WF	WorldFish

EXECUTIVE SUMMARY

This USAID Feed the Future project aims to raise family income by at least US$350 for 60,000 farming families through the transfer of new technology validated in field trials and disseminated through farmer training and demonstrations. It is anticipated that a further 300,000 farmers will adopt new technology through participation in field days and farmer-to-farmer information and technology transfer. The project is implemented by a partnership between the International Rice Research Institute (IRRI), the International Maize and Wheat Improvement Center (CIMMYT), and WorldFish. IRRI is the lead partner.

Between March 2011 and December 2013, the project implemented a subproject called Sustainable Rice Seed Production and Delivery Systems for Southern Bangladesh (SRSPD). This project, managed by IRRI, benefited 1,005,953 farmers through the provision of seed of rice varieties tolerant of soil salinity, flooding, and drought and new high-yielding varieties.

Building on work done in CSISA-BD that tested machine-based conservation farming technology, a sister project (CSISA Mechanization and Irrigation) began in July 2013. This project makes mechanization technology available to farmers via private sector partnerships. This has resulted in the investment of $810,066 by the private sector in the purchase of equipment for sale to rural service providers through their local dealers. To promote this equipment, the project trained 5,580 farmers and, through an innovative video road show, showed the equipment to 25,835 farmers at bazaars and markets. This has all resulted in the use of planting and irrigation equipment on 3,584 hectares.

In FY14, CSISA-BD trained 36,898 farmers (26,819 farmers new to the program this year), conducted trials and demonstrations with 14,424 farmers, and, through participation in training, trials and demonstrations, benefited 36,119 rural households (26,276 new households). This brings the total number of households that have benefited directly from the core project (excluding SRSPD and CSISA-MI activities) to 68,648.

A major focus of project trials, demonstrations, and training is on technology that will allow farmers to intensify cropping patterns and raise aquaculture production in a sustainable manner. One key technology that enables crop intensification is the adoption of early-maturing monsoon-season rice varieties. These mature some 30 days before traditional varieties, thus allowing farmers to plant dry-season (rabi-season) crops such as maize, wheat, oil seed mustard, and grain legumes on time; thus, they are able to use land normally left fallow in the dry season. In FY14, the rice program conducted 6,479 cropping system and variety trials and demonstrations that used early-maturing aman-season rice varieties as part of these systems. Being able to plant an extra crop (e.g., maize, mustard) in a two-crop system can give farmers an extra $600 to $700 per ha.

In the coastal region of southwest Bangladesh, soil salinity results in large areas of land being underutilized during the dry season. Here, the project has been promoting salt-tolerant varieties of rice through 296 variety demonstrations and salt-tolerant crops through 926 sunflower and 119 sesame production technology demonstrations. These trials and demonstrations have shown farmers that it is possible to profitably use land that is saline. Adding sunflower to these systems gives farmers an extra $600 to $700 per hectare.

The maize and wheat program has developed and demonstrated mechanized planting techniques that allow farmers to rapidly plant maize, wheat, and other dry-season crops with minimal land tillage. These conservation agriculture techniques conserve soil moisture and organic matter and reduce planting time and costs. They have also introduced machine harvesting of rice and wheat, which allows farmers to rapidly harvest crops and give them more time for the planting of the next crops. Scaling out of these mechanization systems is an integral

part of the CSISA-MI project. The program this year has been introducing innovative maize/vegetable intercropping systems that plant high-value quick-maturing crops such as amaranth, spinach, and garden pea. These 30−60-day-duration crops can double the income from maize, particularly when maize is planted late. Farmers can thus obtain an extra $560 to $1,120 per hectare.

The rice, maize, and wheat programs trained 27,801 farmers in best agronomic practices for rice, maize, wheat, mustard, sunflower, and sesame and in mungbean production technology. This included planting methods, line planting/transplanting, optimal fertilizer rates/application methods, and crop harvesting and storage methods. The web-based rice crop manager ICT system was used by 780 farmers to obtain farm-specific rice fertilizer and crop production recommendations.

A survey of farmers trained in 2012 by CSISA-BD showed that 30.6% of the farmers that were shown new early-maturing rice varieties continued to grow them in the subsequent year. It also showed that 50% of the farmers that were trained on maize or wheat (relatively new crops to southwest Bangladesh) in 2012 were growing them as a new crop in their farming system. Moreover, in 2013, 91% of them were still applying the technologies and management practices that they learned in 2012. The survey also provided data that allowed the project to tentatively estimate that, for every farmer receiving direct assistance from CSISA-BD, a further 1.57 rice farmers, 1.92 maize/wheat farmers, and 3.59 aquaculture farmers applied some of the technology that the direct farmers adopted.

Production of crops in groups allows farmers to share equipment, training, and marketing opportunities. In FY14, 2,391 farmers in maize groups, 3,152 farmers in premium quality rice (basmati and aromatic rice) groups, 759 farmers in sunflower groups and 4,732 farmers in mustard groups received support through training, trials and demonstrations and links to buyers (millers and feed companies) and input suppliers (maize seed companies).

The aquaculture program provided 10,194 farmers (6,640 farmers new to the program this year) with training and 208 demonstrations of technology that has been shown in farmer-managed trials to raise homestead fish pond production by 194%. Trials using innovative methods for involving women in trial design, management, and data collection to determine the best ways of using shaded and seasonal ponds have been conducted by the aquaculture program. The program is also developing a better understanding of the limitations women face in applying information they learn in aquaculture training to the production of their fish ponds that will be used to develop more effective technology transfer tools for training women.

The project provides women with support through training in crop production and postharvest technology and through participation in field-day events. Aquaculture and the related vegetable production programs attract the greatest participation from women. The project has now begun to consider developing the business capacity of women. In November, a workshop funded in partnership with UN Women was held in Khulna for women who have already initiated micro and small agriculture-based businesses. The workshop had two objectives: to identify constraints faced by women in establishing and expanding a business and to link women-managed businesses in southwest Bangladesh with supermarket chains, food processors, and women's enterprise associations.

The project presented a new M&E plan to USAID for approval in December 2013, prepared comprehensive M&E guidelines for M&E staff, and developed a database system that allows project management to rapidly access project monitoring data.

The USAID M&E team conducted a thorough Data Quality Assessment of the project data collection systems. The team also visited randomly selected CSISA-BD farmers to verify that data collected by the project from CSISA-BD farmers were accurate. As a result of this DQA, the

physical storage of hard-copy M&E data at the hub level has been greatly improved and the development of the M&E guidelines and the database system was commissioned.

In March, the project had a Mid-Term Evaluation from an independent external evaluator. The evaluation recommended a continuation of the project; scaling out of key technologies associated with maize, oil seed, and fish production; as well as greater integration of CSISA-BD work with government institutions.

The project had the pleasure of hosting two visits by U.S. Ambassador Dan Mozena during the reporting period. One was to Sutarkhali in October 2013 (see USAID Frontline article at www.usaid.gov/news-information/frontlines/extreme-poverty/weathering-storm-rice-lifts-bangladesh-village-saltwater) and the second was to two sites in Barisal District during the ambassador's visit to FtF projects in Barisal Division in February 2014.

As a result of nationwide strikes (Hartals), the project lost 41 working days out of a potential 88 working days in the four months from October 2013 to January 2014. Despite this, most of the trial and demonstration targets were met.

1. INTRODUCTION

1.1 Background

The Cereal Systems Initiative for South Asia in Bangladesh (CSISA-BD) project is implemented through a partnership among three CGIAR centers, IRRI, CIMMYT, and WorldFish. CSISA-BD is funded by USAID's Feed the Future (FtF) initiative, and aims to test and disseminate new cereal system-based technologies that will raise family income by at least US$350 for 60,000 farming families. It is anticipated that an additional 300,000 farmers will adopt new technology through participation in field days and farmer-to-farmer information and technology transfer. This is one of several USAID FtF projects in Bangladesh that contribute to achieving "improved food security," the flagship development objective for the U.S. government's (USG) FtF strategy in Bangladesh.

CSISA-BD, building on and diversifying the activities of an earlier South Asia-wide project, began in Bangladesh in October 2010, and began implementing activities in June 2011. The project uses the "hub" concept for organization and implementation at the field level within districts. Each hub brings together a set of partners and provides a basis for the identification and participatory testing of new technology. During the course of the project, two sets of technology were found to be beneficial to farmers and were therefore scaled out to a wider range of farmers through subprojects. These were stress-tolerant rice varieties and mechanized planting and harvesting. The stress-tolerant rice variety project (**Sustainable Rice Seed Production and Delivery Systems for Southern Bangladesh—SRSPDS project**) began in October 2011 and, after two no-cost extensions, was completed in December 2013. The project distributed seed packs of new rice varieties to almost 1 million farmers, established a network of seed growers working through three associations, and resulted in 9% of rice-growing farmers in southwest Bangladesh growing the varieties distributed by the project. The mechanization project, **CSISA Mechanization and Irrigation (CSISA-MI) project**, began work in July 2013. The project builds upon the lessons learned and opportunities identified by CSISA-BD and aims to scale out agricultural mechanization and irrigation services to benefit smallholder farmers in the Feed the Future zones of southern Bangladesh. While CSISA-BD maintains a focus on adaptive technology testing, deployment of new crop varieties, direct training work with farmers, and facilitating output markets, CSISA-MI goes beyond these to focus on upstream market interventions involving machinery manufacturers, dealers, and local service providers. Integration of these two pursuits results in synergy, rather than duplication, between the CSISA-BD and CSISA-MI projects.

As a general rule, IRRI is responsible for implementing activities related to rice production, CIMMYT is responsible for wheat and maize production, and WorldFish for aquaculture and pond bank vegetable production. There is, however, considerable blurring of these divisions as each CGIAR center works closely with the others in this partnership to implement trials and demonstrations in the context of complex farming systems.

1.2 Impact of civil disturbance on project activities

As a result of nationwide strikes (Hartals) called by political parties in the weeks preceding the national elections held on 5 January 2014, the project lost, in the four months from October to January, 41 working days out of a potential 88 working days. Despite this, most trials and demonstrations were planted on time. Staff training and farmer training suffered as the project was not able to guarantee the safety of farmers traveling to training venues and staff often could not travel to Dhaka for training. Senior staff members also were not able to travel to hubs for almost two months and this undoubtedly had an impact on the quality of the work done.

1.3 Project Mid-Term Review

The project had a Mid-Term Review (MTR) in March and April 2014 by a team of external consultants supplied by Dexis Consulting Group of Washington, D.C., USA. The team was in Bangladesh for 34 days, of which 15 were spent visiting four of the six project hubs (Jessore, Khulna, Barisal, and Mymensingh). The MTR recommended a continuation of the project, emphasizing the scaling out of maize, sunflower, and tilapia production and marketing and greater integration of project activities into the government research and extension systems.

1.4 Visitors to the project

U.S. Ambassador Dan Mozena

The project had the pleasure of hosting two visits by U.S. Ambassador Dan Mozena, one to Sutarkhali in October 2013 (see USAID Frontline article at www.usaid.gov/news-information/frontlines/extreme-poverty/weathering-storm-rice-lifts-bangladesh-village-saltwater) and the second to two sites in Barisal District during the ambassador's visit to FtF projects in Barisal Division in February 2014. As is usual with the ambassador, he expressed a keen interest in the science behind the work on the project implements and the impact it has on the lives of farmers.

1.5 Project area of operation

The project works in 30 districts (see Fig. 1), 17 of which are in the FtF zone of influence in southwest Bangladesh and 13 are in northern and northwest Bangladesh.

1.6 Project objectives and M&E system

The overall objectives of CSISA-BD are to increase household income of project farmers by $350 through increased on-farm productivity (Fig. 2).

A revised Project Monitoring and Evaluation Plan (PMEP) was presented to USAID in November 2013. This includes the new Results Framework presented in Figure 2.

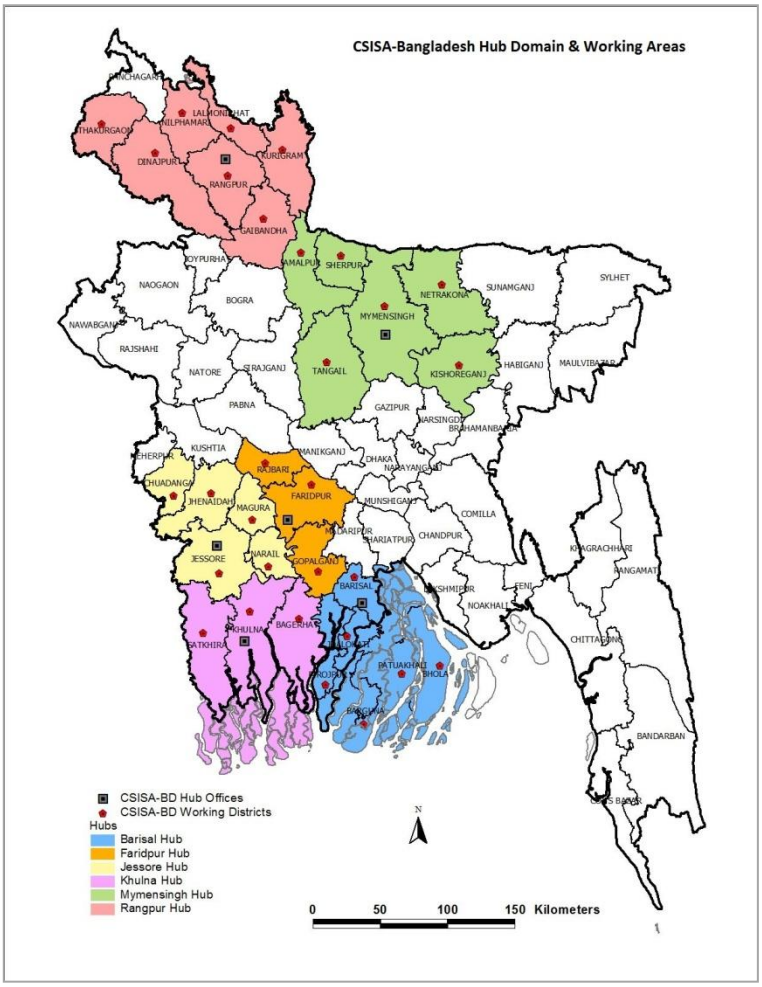


Fig. 1. Map showing project area of intervention.

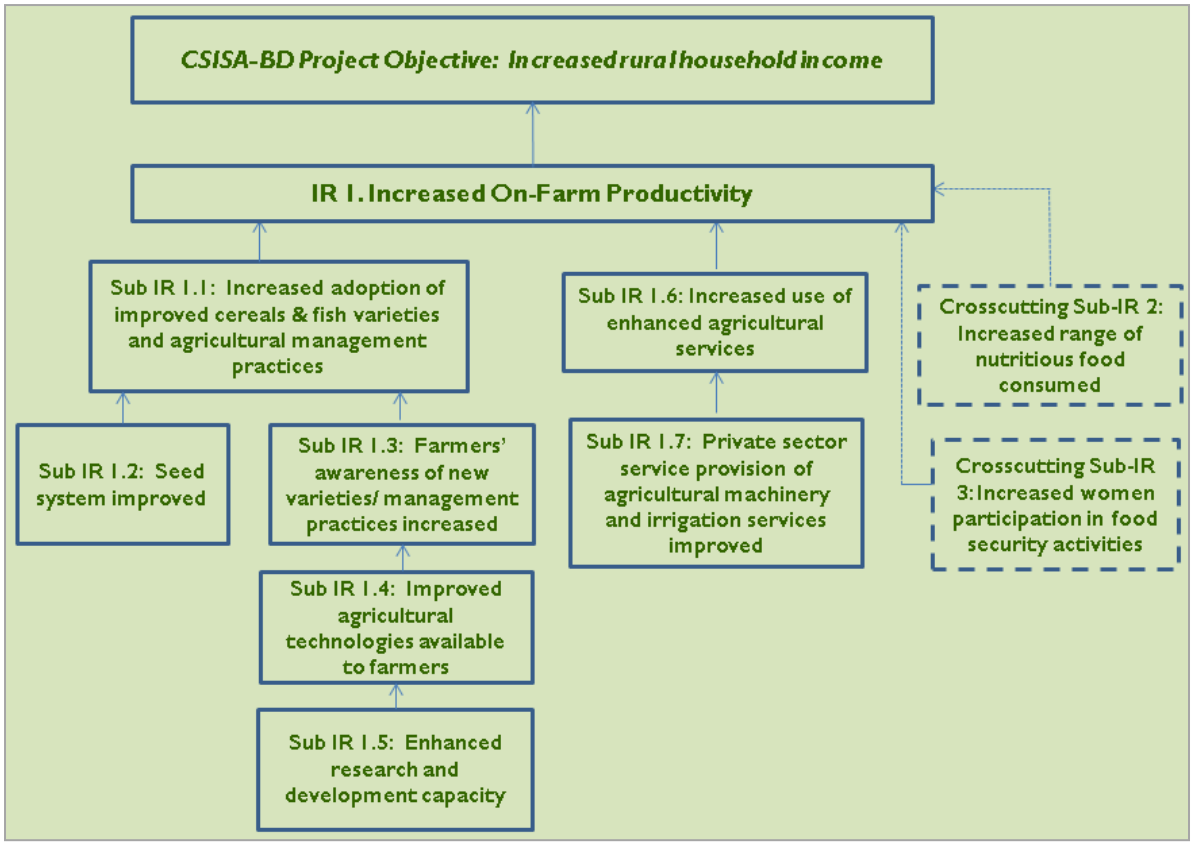


Fig. 2. CSISA-BD Results Framework

2 SUMMARY OF FtF INDICATOR REPORT

4.5-4 Gross margin per unit of land, kilogram, or animal of selected products (crops/animals/fisheries and selected varieties by country)

The actual gross margins will be reported based on data to be derived from the annual project technology adoption and impact survey (AIS) for Year 2, 3, and 4 farming households. This survey will be completed in August 2015 and the results will be available in the final evaluation report in 2015.

4.5.2-2 Number of hectares under improved technologies or management practices as a result of USG assistance

CSISA-BD counts total area under improved technologies through three activities: adaptive research trials (ARTs) and demonstrations (Table 1).

Demonstrations are used by the project to promote farmer awareness of improved seed/cropping technologies, crop and fish varieties/species, machinery, and agricultural/aquaculture management practices. Demonstrations also play an important role by putting technologies into farmers' fields so that people can see how these improved technologies can directly benefit them.

The area calculated is based on the area of demonstration and trial plots planted by the three CGIAR centers. The data provided are therefore purely output data. Data on the actual area of land under new technology disseminated by the project will be collected through the annual "technology adoption" survey conducted in the first quarter of PY4.

Table 1. Area (ha) under improved technology or management practices as a result of USG assistance in Year 4.

Activities under indicator (ha)	CSISA-BD				Activity totals (CSISA-BD/excluding SRSPDS)		CSISA-MI		SRSPDS (FtF zone)
	FtF zone hubs		N hubs		FZ + N hubs		FtF zone hubs		
	Males	Females	Males	Females	Males	Females	Males	Females	
Adaptive trials	*40*	*4*	*17*	*1*	*57*	*5*			
Demonstrations	*1,020*	*81*	*577*	*53*	*1,597*	*134*	*3,502*	*82*	
Subtotals in Year 4	*1,060*	*85*	*594*	*54*	*1,654*	*139*	*3,502*	*82*	
CSISA-BD project total area in Year 4	***1,145***		***648***		***1,793***		***3,584***		
Subtotals in Year 3	***1,232***	***108***	***698***	***54***	***806***	***162***			***46,436***
CSISA-BD project total area in Year 3	***1,340***		***752***		***968***				***46,436***
Subtotals in Year 2	*441*	*38*	*592*	*27*	*1,033*	*65*			***139,645***
CSISA-BD project total area in Year 2	***479***		***619***		***1,098***				***139,645***
Subtotals in Year 1	*10*	*1*	*6*	*2*	*16*	*3*			
CSISA-BD project total area in Year 1	***11***		***8***		***19***				
CSISA-BD subtotal	***2,743***	***232***	***1,890***	***137***	***4,633***	***369***	***3,502***	***82***	***186,081***
CSISA-BDpProject total area	***2,975***		***2,027***		***5,002***		***3,584***		***186,081***

4.5.2-5 Number of farmers and others who have applied new technologies or management practices as a result of USG assistance

Participants under this indicator include farmers who have applied CSISA-BD-supported technologies and agricultural management practices for two activities: demonstrations and adaptive research trials. Some 758 producers participated in adaptive research trials and 13,666 conducted demonstrations, giving a total of 14,424 producers applying new technologies in this reporting period. Table 2 below shows the distribution of participating farmers applying new technologies and practices according to each project component and/or area, and by gender.

Table 2. USG-supported producers applying new technology in Year 4

Activities under indicator	*FtF zone hubs*		*N hubs*		*Activity totals (FZ + N hubs)*		*SRSPDS (FtF zone)*
	Males	*Females*	*Males*	*Females*	*Males*	*Females*	
Adaptive trials	*520*	*49*	*176*	*13*	*696*	*62*	
Participatory farmer trials	*8,106*	*770*	*4,385*	*405*	*12,491*	*1,175*	
CSISA-BD component total in Year 4	*8,626*	*819*	*4,561*	*418*	*13,187*	*1,237*	
CSISA-BD project total area in Year 4	*9,445*		*4,979*		*14,424*		
CSISA-BD component total in Year 3	***9,382***	***1,192***	***5,563***	***762***	***14,945***	***1,954***	***326,272***

CSISA-BD project total area in Year 3	***10,574***		***6,325***		***16,899***		***326,272***
CSISA-BD component total in Year 2	***3,928***	***657***	***4,344***	***387***	***8,272***	***1,044***	***673,245***
CSISA-BD project total area in Year 2	***4,585***		***4,731***		***9,316***		***673,245***
CSISA-BD component total in Year 1	***49***	***25***	***26***	***19***	***75***	***44***	
CSISA-BD project total area in Year 1	***74***		***45***		***119***		
CSISA-BD component total	***21,985***	***2,693***	***14,494***	***1,586***	***36,479***	***4,279***	***999,517***
CSISA-BD project total area	***24,678***		***16,080***		***40,758***		***999,517***

4.5.2-7 Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training

For the current reporting period, CSISA-BD has provided direct training support to 27,310 farmers, with around 21% being females (see Table 3, line 1). More than 32,308 other farmers have had exposure to new varieties and technologies and seen results in the field through farmer field days and cross visits.

CSISA-BD has provided capacity building to 742 individuals, including project staff and partner NGOs, as part of its commitment to developing the agricultural sector of Bangladesh.

Under CSISA-MI, a total of 5,840 farmers received short-term support and 1,075 GoB, NGO, and private sector personnel received capacity-building support. Among them, 5,218 are males and 622 are females.

Table 3. Activity-wise breakdown of USG-supported short-term training in Year 4

Activities under indicator	**FTF zone hubs**				**Northern hubs**				**Total**			
									CSISA-BD		**CSISA-MI**	**SRSPDS**
	Direct		**Indirect**		**Direct**		**Indirect**		**Direct**	**Indirect**	**Direct**	**Direct**
Gender	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**				
Direct farmers	*14,257*	*4,412*			*7,211*	*1,430*			*27,310*		***4,765***	
Farmer field day			*13,836*	*8,035*			*6,120*	*3,045*		*31,036*		
Cross visits (farmers)			*980*	*208*			*51*	*8*		*1,247*		
Workshops (farmers)			*17*	*8*						*25*		
Capacity building (GoB)	*122*	*8*			*54*	*6*			*190*		***16***	
Capacity building (private sec.)	*55*	*0*			*81*	*5*			*141*		***920***	
Capacity building (NGOs)	*247*	*15*			*140*	*9*			*411*		*139*	

Subtotals in Yr4 (M/F)	*14,257*	*4,412*	*14,833*	*8,251*	*7,211*	*1,430*	*6,171*	*3,053*	*27,310*	*32,308*	***5,840***	
Subtotals (M+F) in Yr4	*18,669*		*23,084*		*8,641*		*9,224*		*59,618*		***5,840***	
Subtotals (M+F) in Yr3	***25,131***		***25,926***		***8,327***		***10,086***		***69,470***			***1,312,935***
Project total In Yr3	***51,057***				***18,413***							
Subtotals (M+F) in Yr2	***14,882***		***13,562***		***6,703***		***10,150***		***45,297***			
Project total in Yr2	***28,444***				***16,853***							
Project total in year 1									***5,939***			
Subtotals (M+F)	***58,682***		***62,572***		***23,671***		***29,460***		***180,324***			***1,312,935***
Project total	***121,254***				***53,131***							

4.5.2-13 Number of rural households benefiting directly from USG interventions

For the current reporting period, 36,119 households have been benefited. Of this figure, 26,276 (from southern and northern hubs) are new HHs while 9,843 are continuing HHs. Among those new households, 17,839 represented the FtF zone (southern zone) and 8,437 households represented the northern zone.[1]

4.5.2-37 Number of MSMEs, including farmers, receiving business development services from USG-assisted sources

During this reporting period, a total of 276 MSME received business development services from USG-assisted sources, of which 229 are micro enterprises, 45 are small enterprises, and only 2 are medium enterprises. In the project, local service providers (LSPs) are treated as a small enterprise that provided services to farmers in 46 upazillas. Among those, only one LSP is female. A dealer is treated as a medium enterprise; by this reporting period, 45 dealers were working in 32 upazillas under the project area. Two importers (ACI and RFL) were working with the CSISA-MI project and importing agro-machinery.

CUSTOM Indicator 1 Value of private sector investment in agricultural machinery and equipment resulting from project interventions

During this reporting period, importers, dealers, and LSPs invested in total US$810,067 to purchase agricultural machinery for water conveyance, machines for land preparation and planting, and machines for harvesting and postharvest operations (Table 3).

[1] CSISA-BD acknowledges the potential for double-counting households; however, and for the time being, referential and experiential feedback from the hubs has indicated that this is, at present, a minor discrepancy, as the vast majority of households have 1-farmer/1-household participation within the project. At the same time, it has been duly acknowledged that there are instances of multiple household members participating in the project, and hence double-counting of households, by hub staff as well. CSISA-BD is currently reviewing its documentation system for field-level data collection and data entry/capture. The M&E team is also working to develop an overall and encompassing strategy for a results-based M&E system that better addresses the new organization of FtF indicators, and that can take into full account indicator definitions and the several additional levels of data disaggregation.

Table 3. Service-wise investment by importers, dealers, and LSPs in Year 4

Item	Achieved	Notes on investment breakdown[2] (in US$)
Water conveyance	327,974.79	Importers: 327,974.79 Dealers: 27,160.58 LSPs: 28,404.37 (AFP)
Machine land preparation and planting	252,901.65	Importers: 252,901.65 Dealers: 51,205.18 LSPs: 28,340.84 (seed fertilizer drill machinery)
Machine harvesting and postharvest operations	229,190.94	Importers: 229,190.94 (reapers) Dealers: 11,521.03 LSPs: 14,715.03
Total	810,067.38	

CUSTOM Indicator 2 Number of farmers using improved agricultural services

During the current reporting period, 9,073 farmers received services from LSPs, of which 8,830 were males and 243 were females (Table 4). Among them, 5,163 farmers received support for water conveyance, 2,122 farmers received support on mechanized land preparation, and 1,788 farmers received support on mechanized harvesting and postharvest operations.

Table 4. Service-wise farmers' coverage by gender in Year 4

Item	*Achieved*	*Notes*
Water conveyance	*5,163*	*Male farmers: 5,072* *Female farmers: 91*
Mechanized land preparation and planting	*2,122*	*Male farmers: 2,008* *Female farmers: 114*
Mechanized harvesting and postharvest operations	*1,788*	*Males: 1,750* *Females: 38*
Total	*9,073*	*Males: 8,830* *Females: 243*

[2] We use US$1 = BDT 77.25 for converting BDT into US$.

3 RESULTS AND ACHIEVEMENTS

This section presents the results and achievements of the project according to the intermediate (IR) and sub-intermediate results (Sub-IR) depicted in Figure 2. The report will present results in the following order:

- Scaling out and adoption of new technology: Sub-IR 1.1. Increased adoption of improved cereals and fish varieties/species and agricultural/aquaculture practices.
- Seed systems: Sub-IR 1.2. This will cover the activities of the SRSPDS project and other seed multiplication activities of the project.
- Farmer training and demonstrations: Sub-IR 1.3. Farmers' awareness of new varieties and management practices.
- Research: Sub-IR 1.4. Improved agricultural technologies available to farmers. This covers the work done by the project to validate and develop new technology.
- Mechanization and irrigation: Sub-IR 1.6. Increased use of enhanced agricultural services; and Sub-IR 1.7. Private-sector service provision of agricultural machinery and irrigation services improved; this relates to the activities of the CSISA-MI project.
- Enhanced research and development capacity (Sub-IR 1.5): ToT training for project staff and partners and postgraduate training for GoB staff.
- Cross-cutting Sub-IR 2: Range of nutritious food consumed, and Sub-IR 3: Increased women's participation in food security activities, will be presented as separate sections.

3.1 Increasing on-farm productivity (IR 1)

On-farm productivity will be increased by disseminating proven technology to as many farmers as possible. Two major issues are addressed through the program: increased productivity of crop and aquaculture systems and increased intensity of cropping and aquaculture systems.

Increased crop and aquaculture productivity: This is achieved through training and demonstrations that show farmers the best methods for raising crops and fish, developing systems that allow farmers to obtain good seed of the best varieties, and testing and introducing new crop and fish varieties.

Increased cropping intensity*:* This involves increasing the number of crops grown where crops could not previously be grown or, in the case of aquaculture, more fish production cycles each year. In most cases, a key perquisite for increased cropping intensity is the introduction of early-maturing aman-season rice varieties. This allows dry-season crops to be planted earlier. This not only increases crop yield but also allows crops to be grown in the gap between the aman and boro rice crops or to grow two, instead of only one, rabi crops. It can also allow crops to escape rising soil and water salinity or late dry-season drought and high temperatures. Cropping intensity can also be increased through the introduction of rice varieties that can grow on land frequently flooded during the monsoon and mechanized planting and harvesting that allow for faster turnaround between crops.

3.1.1 Adoption of improved cereals and fish varieties and agricultural management practices (Sub IR 1.1)

In the following sections, the work of the project testing new varieties and technologies and carrying out demonstrations and training farmers on the use of the best of these technologies will be described. This work should result in farmers adopting new varieties and technologies.

During the latter part of 2013, a survey of Year 2 (2011-12) CSISA-BD farmers was conducted to determine what proportion of those farmers continued to use the technology they had been shown through CSISA-BD interventions and how many other farmers in their village copied what they had learned. In July 2014, farmers who were reported by CSISA-BD direct beneficiaries to have adopted new technology were contacted in a follow-up survey to document the technology they had indirectly adopted. In September 2014, enumerators were trained for another survey in which, in addition to a sample of 2012 farmers, 2013 farmers will be interviewed. Again, this survey will be used to identify which technologies continue to be used by farmers. More details of these surveys are presented in the M&E section, Section 4.2

This section of the report offers a few preliminary results from the survey conducted in November 2013 of 2012 farmers. The survey targeted 1,200 farmers overall that were randomly selected from each of the six project hub areas. Of these farmers, 400 had worked directly with IRRI, 400 with CIMMYT, and 400 with WorldFish.

Rice

Farmer demography: The average area of land cultivated, excluding homestead land and ponds, was 0.46 ha in the FtF zone and 0.5 ha in the non-FtF zone. Although HHs on average own 0.5 hectare of land, HHs in the lowest 10% owned less than 0.04 hectare, whereas the HHs in the highest 10% owned more than 1.36 hectares. This means that the project has worked with the full spectrum of farmers in Bangladesh, from the poorest to the richest.

Training: About half of the HHs (44.7%) received training on boro rice and more than half (58.2%) received training on aman rice but only 7% of the HHs received training on both boro and aman rice. Farmers indicated GAP ("good agronomic practices") training as the most useful training.

Variety adoption: Cultivation of older varieties drops after farmer training.

Short-duration aman rice varieties are rapidly adopted. BINA Dhan 7 cultivation went from zero to 30.6% of the HHs in the FtF zone and to 47.7% of the HHs in the non-FtF zone. New varieties introduced by CSISA-BD are grown on half of the farmers' land after training. On average, each HH cultivated 0.36 ha using CSISA-introduced boro varieties compared with 0.33 ha using older varieties.

Seed dealers were a major source of seed for many of the new varieties. For seed of the new boro rice varieties promoted by CSISA-BD, 35.4% of this seed was purchased from private seed dealers. Many farmers (57.1% for boro and 74.3% for aman) want to continue to grow the new varieties after the first season of cultivation.

Most farmers want to continue using new cropping systems. The new cropping systems demonstrated based on short-season aman rice varieties proved to be very popular. For instance, 78.9% of the farmers who tried the aman rice-mustard-boro rice cropping system intend to use it in the next season.

Farmers who adopted the rice production technology promoted by CSISA-BD had gross margins for their boro rice which were 64% ($280) and for their aman rice 41% ($175) higher than those for farmers who did not adopt this technology.

Passing on the message: Some 60% of direct farmers transferred what they learned to other farmers. For every farmer taught by CSISA-BD in rice technology, another 1.52 farmers copied and adopted some of this technology. Transplanting rice in lines is the most common technology adopted by the indirect beneficiaries (31.1%), followed by good agronomic practices, including younger seedlings, timely planting, optimum fertilizer management and IPM (24%), seed production (13.8%), and improved seed storage system (10.1%).

Maize and wheat

Demographics: In terms of farmer gender, 314 (82%) are males and 69 (18%) are females. The average and median age of the respondent farmers was 42 years and 40 years, respectively, ranging from a minimum of 18 years to a maximum of 86 years. On average, the households of the sample own 189 decimals (0.77 ha) of land, with total land area used (includes land leased in or share-cropped) being 245 decimals (0.99 ha).

Interaction with CSISA: The principal manner in which project beneficiary farmers are engaged by CSISA-BD is through a training event and/or participation in an on-farm trial or demonstration. For the former, 357 (93%) of the respondents reported that they attended a CSISA-BD training event in Year 2.

Technology adoption: As shown in Table 5, following their participation in the above activities, CSISA farmers apply improved technologies and/or management practices in their fields—both immediately and in subsequent seasons/years.

Table 5. Application of improved technologies and/or management practices by sampled Year 2 CSISA-BD farmers (N = 383).

Variable	Ref. no.	% of N	FPA* (no.)	FPA* (%)
Aggregate application of training† in the same year (Y2)	--	--	353	91
Aggregate application of training† in the following rabi season (Y3)	--	--	353	91
No. of demo/trial farmers; adoption of tech. in Y3 based on a demo/trial	124	32	114	92
No. of maize farmers; application (in Y3) of most useful thing learned	287	74	277	97
No. of wheat farmers; appl. of most useful thing learned	125	32	120	96

* FA = full application of improved technologies/management practices; FPA = full + partial application.

† Refers to the application of technologies/management practices learned in either a maize or wheat training event.

Year 2 farmers were also asked about the application of the most important/useful thing they learned from the training they attended. Table 6 shows that 277 of 287 maize farmers (97%) stated that they fully or partially applied the most important/useful thing learned, whereas 120 of 125 wheat farmers (96%) reported the same thing. Table 6 shows a ranking of the most important/useful technologies and management practices learned by farmers.

Table 6. Ranked list of most important/useful improved technology or management practice learned by Year 2 CSISA-BD farmers.

Maize (n = 284)			Wheat (n = 125)		
Technology/mgt. practice	**No.**	**%**	**Technology/mgt. practice**	**No.**	**%**
Line sowing/seed and row spacing	79	27.8	Fertilizer application rate	25	20.0
Fertilizer application rate	52	18.3	CA elements	21	16.8
Cultivation methods	28	9.9	Irrigation: timing and/or rate	16	12.8
CA elements	22	7.8	Seed preparation, preservation, and storage	12	9.6
Irrigation: timing and/or rate	18	6.3	Fertilizer timing of application	9	7.2
Intercultural operations	17	6.0	Line sowing/seed and row spacing	9	7.2

Note also that, of the 125 sampled households that grew wheat in Year 3, a total of 55 (44%) households used at least one of the new varieties of wheat (BARI Gom 25, 26, 27, 28) being promoted by CSISA-BD, yielding 4.19 tons/ha on average.

Aquaculture

The adoption and impact survey of Year 2 farmers (AIS-Y2F) indicates that at least one member of a household sampled for aquaculture Year 2 farmers obtained training on fish or shrimp culture. Almost half of the sampled households (46.1%) cultured fish according to project recommendations and the fish were cultured year-round by 82.6% of the households.

Of the households that were sampled, 41% grew prawns or shrimp (on an average of 0.34 hectare) according to project recommendations.

Among the different fish cultivation technologies promoted by CSISA-BD, the highest production per hectare and almost the highest gross margin were found for improved farming of tilapia in pond and horticulture on dikes (see Fig. 3).

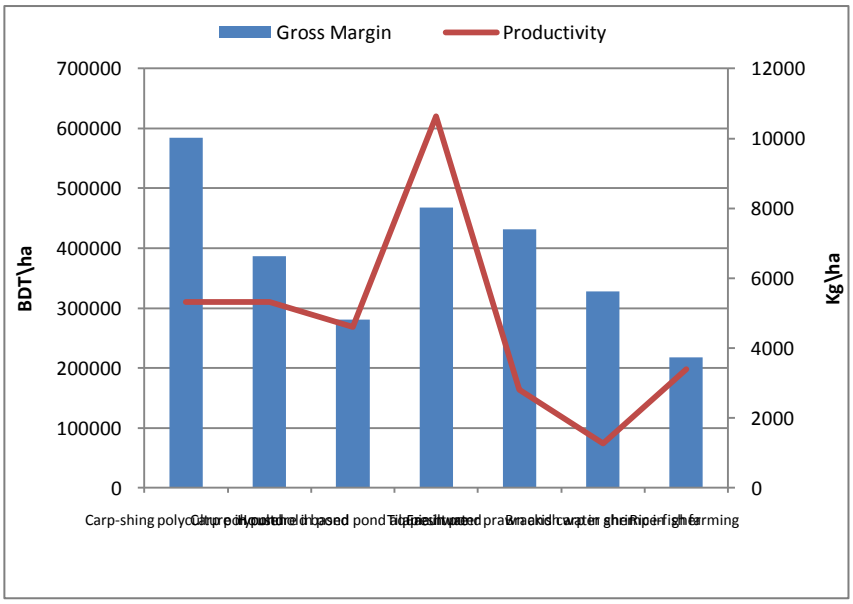


Fig. 3. Gross margin and productivity of Year 2 farmers.

Passing on the message: Some 93% of the direct participants transferred what they learned from the project to other farmers and, on average, each direct CSISA farmer disseminated knowledge to another 3.59 farmers who were mostly neighbors.

Mechanization (CSISA-MI)

During the first year of the project, CSISA-MI's work led to 3,584 hectares of land being brought under different targeted agricultural machinery and irrigation services. Out of this number, 2,322 ha were irrigated by LSPs using fuel-efficient axial flow pumps (AFPs) supplied primarily through purchases made from CSISA-MI's core private sector partner, Rangpur Foundary Ltd. (RFL). RFL and LSPs invested $327,974 of their own funds in AFP services. In addition, 767 hectares were cultivated using seeder-fertilizer drills and bed planters to plant a number of crops, including rice, maize, wheat, jute, and vegetable crops (onion and garlic), among many others. In order to make this happen, CSISA-MI's private sector partners invested $482,092 of their own funds to expand the use of planter equipment. A further 594 ha of wheat and rice were harvested using multicrop reapers, through local service provision and the action of another core private sector partner, ACI. Sales of reapers to LSPs are currently ongoing. A total of 9,073 farmers in the FtF zone benefited from the project's activities through interventions implemented by the project and private sector partners. During the same time period, 5,840 farmers, of which 5,218 were males and 622 were females, received short-term hands-on training on different agricultural technologies under CSISA-MI, and a total of 276 entrepreneurs received business development services from the project. Importantly, CSISA-MI exceeded its Year 1 targets in terms of the number of individuals trained and in terms of the value of private sector investment in expanding the use of machinery.

These figures fall in line with the project's scaling strategy that seeks to develop core market and partnership systems in the first three years of the project, which are anticipated to facilitate full scaling up and the take-off of independent adoption in later years. Unfortunately, because of political unrest before and during Bangladesh's parliamentary elections during October-January 2013, many of CSISA-MI's planned field activities were hampered. But, despite these problems, more than reasonable progress was made.

SUCCESS STORY

Premium-Quality Rice: Banglamati and Chinigura

Banglamati: farmers and millers benefit

The farmer

Hafizur Rahman, 40, from Badpukuria Village, Jhenaidha District in southwest Bangladesh, was especially interested when other farmers began planting BRRI dhan50. It was introduced to the farming community as a premium variety by CSISA-BD and its partner NGO Pride. After the 2013 boro season harvest in mid-May, Rahman could see that his neighbors were doing well with the new crop, making higher profits. He decided that the 2014 boro season was the right time to plant BRRI dhan50.

In both the 2013 and 2014 boro seasons, Rahman cultivated 20 decimals of land (0.08 hectare). In 2013, he planted the local varieties Subal Lata and Ratna, as well as BRRI dhan28. This year, he cultivated BRRI dhan50 and 55 as well as Subal Lata. His average yield in both years was 550 kg from his 20-decimal plot (6.9 t/ha), but the price he is getting for BRRI dhan50 is BDT 24/kg ($300/t) compared with that of the other varieties, which averaged BDT 20/kg ($260/t). The extra 2,200 taka ($28) income will be useful to Rahman, who plans to buy cattle for beef production, as well as support the education of his two young daughters. "I'm very happy to get support and guidance from CSISA-BD-IRRI and Pride. I'm planting new varieties such as BRRI dhan50 (and 55 as well as BINA dhan7) that will give me better yields and a higher price than local varieties."

The miller

The Jessore hub team provides local millers with advice on how to mill new rice varieties such as Banglamati. The millers initially found it difficult to mill long slender basmati-type rice varieties without having a high proportion of the grains broken during milling. Through a process of trial and error supported by the project, millers succeeded in making modifications to their drying, processing, and milling systems that have allowed them to mill basmati-type rice with acceptable levels of broken rice grains. A further problem was that the quantities produced by individual farmers were often too small to interest local millers. Again, with assistance from the project, groups of farmers pooled their production to attract millers.

Abul Kashem Sarkar, 53, was among the first to begin milling BRRI dhan50. He operates a mill just up the road from Hafizur Rahman, in Uttar Narayanpur. Sarkar was confident that the new variety would be a winner, irrespective of the small difficulties involved. "The grain needs special care for proper drying and cooling. It takes double the time and double the stirring. But, if anyone should taste the BRRI dhan50, they will never choose to eat another variety. It is the best tasting!"

3.1.2 Seed systems

This section recognizes the importance of good seed supply systems and the key role the private sector can play in ensuring that farmers have access to the best varieties. Three activities related to seed production have been initiated by the project: the implementation of the Sustainable Rice Seed Production and Delivery Systems for Southern Bangladesh (SRSPDS) project, the multiplication of new varieties of wheat by farmers' groups, and assistance to hatchery owners to produce quality fish seed.

The Sustainable Rice Seed Production and Delivery Systems for Southern Bangladesh (SRSPDS) project began in October 2011 and, after two no-cost extensions, was completed in December 2013.

Within a year of inception of the project, it was realized that farmers urgently needed varieties of rice that had tolerance of salinity, submergence, and drought to help them reduce losses incurred during monsoon-season floods and droughts and to help them use land prone to salinity in both the monsoon and, more importantly, the dry season. These varieties were available but the rate at which they were becoming available to farmers through normal commercial and government-sponsored demonstration processes was very slow. It was therefore decided to establish a project that would distribute seed packs of these new rice varieties to as many farmers as possible in salinity- and flood-prone areas of southwest Bangladesh and, in doing this, strengthen the capacity of small and medium-sized seed producers and government institutions to produce seed.

1. The project met its targets, and was able to disseminate seeds of HYVs and HY-STRVs to 999,517 farm households covering 215,000 ha of rice area through its direct interventions. Of these, 176,080 received seed of salinity-tolerant rice varieties and 171,723 received seed of submergence-tolerant varieties. The remaining seed distributed was mainly of short-duration monsoon-season rice varieties and the latest boro-season varieties.
2. The project worked closely with the three seed associations representing 333 seed companies, of which 33 are managed by women (Fig. 4). The associations were also provided with technical advice and promotional materials; ensured the supply of breeder seed of the new varieties by linking them with BRRI, BINA, and other research institutions; and given help in capacity building of their seed growers. Seed production by these associations increased from 935 tons to 2,300 tons in the 1.5 years the project worked with them.
3. For the first time, large seed companies such as Lal Teer, Energypack, and ACI were encouraged to undertake the seed production programs for STRVs such as BINA 8, BINA 10, and BRRI dhan51 and 52.
4. The project organized a workshop in Dhaka to facilitate increased collaboration in the seed sector between India and Bangladesh.

Fig. 4. Packing seeds at a small company owned by a woman.

Wheat seed production

As in past years of the project, one of the key activities undertaken in Year 4 by CSISA-BD was quality wheat seed production by CSISA farmers and the facilitation of marketing through local

seed traders. This benefits project farmers directly by increasing their income, but it also helps resource-poor farmers to access quality seed of their preferred varieties locally with an affordable price or through bartering systems. The recently released high-yielding and stress-tolerant wheat varieties BARI Gom 25, 26, 27, and 28 were multiplied by CSISA farmers in 2013-14, such that a total of 49 tons of seed of these varieties were produced (Table 7). This amount will be enough for approximately 2,884 farmers to plant at least 400 ha in the coming 2014-15 wheat season. This means that more farmers beyond the project will benefit from improved wheat genotypes, and planting of these varieties reduces the risk of crop failure due to their stress tolerance traits such as terminal heat tolerance (BARI Gom 26, 28), salinity tolerance (BARI Gom 25), and stem rust tolerance, including Ug99 (BARI Gom 26, 27).

Table 7. Wheat seed production (tons) by CSISA-BD farmers, 2013-14 rabi season.

Variety	Mymensingh		Faridpur		Rangpur		Jessore		Total tons	Total farmers
	Tons	No. of farmers	Tons	No. of farmers	Tons	No. of farmers	Tons	No. of farmers		
BARI Gom 25	0.6	9	5.5	42	--	--	--	--	6.1	51
BARI Gom 26	7.8	72	2.9	46	3.2	51	10.2	18	24.1	187
BARI Gom 27	1.3	15	0.1	2	1.4	17	3.3	3	6.1	37
BARI Gom 28	4.6	47	0.15	5	4.2	24	3.8	9	12.8	85
Total	**14.3**	**143**	**8.65**	**95**	**8.8**	**92**	**17.4**	**30**	**49.1**	**360**

Depending upon the location, farmers are obtaining excellent prices for their product (BDT 35−50 per kg), whereas the grain price is only BDT 20/kg at the time of harvesting. In Mymensingh hub, CSISA-BD linked with the private company *Joint Agro Business Centre* (JABC) in order to contract with farmers from 10 village-level marketing groups to produce seed. As in the past two years, JABC provides the farmers with training (with assistance from CSISA-BD) and ensures seed buyback through a contractual arrangement. JABC sells the seed in 10-kg and 20-kg seed packets to farmers' groups in the Mymensingh hub. This is a great example of the development of local-level seed entrepreneurship.

Working to expand the market for hybrid maize seed

The success that CSISA-BD had in promoting maize in the Barisal hub in Year 2 began to pay off in Year 3 when the project attracted the attention of *Katalyst*, a market development project with experience in expanding the maize sector in northern Bangladesh and the Chittagong Hill Tracts region. Together with the agricultural input company *Petrochem Limited*, Katalyst approached CIMMYT to expand Petrochem's small presence in the Barisal region in order to sell more hybrid maize seed and to establish contract farming for maize. Thus, in Year 4, the efforts of CSISA-BD to promote maize as a profitable cash crop in the south began to be leveraged with private sector involvement.

In 2013-14, CSISA-BD began working with Petrochem through a training of trainers (ToT) approach in training nine Petrochem staff members and 20 of their distributors/dealers on various technological and managerial aspects of maize production. Petrochem provided two Pioneer hybrids (P3396 and P3491) for CSISA-BD to test as part of 18 on-farm structured demonstrations that covered a total of 5 ha. Results were excellent for this region: P3396 (included in 14 demos) averaged 7.97 t/ha, while P3491 (included in four demos) averaged 7.74 t/ha. Petrochem also distributed seeds through the CSISA-BD maize program to 189 project beneficiaries. The yields obtained by the 189 farmers are impressive, considering that the vast

majority of these farmers used variety P3396 to obtain 6.82 t/ha, which is only 2.3% less than the national average (6.98 t/ha in 2012-13) (Table 8).

Table 8. Data for Pioneer hybrid maize varieties applied in the fields of CSISA-BD farmers of Barisal hub, 2013-14 rabi season.

Variety	No. of farmers	Percent (weight)	Area (ha)	Yield (t/ha)	Yield difference* (%)	Yield (weighted average)
P3396	*148*	*78.3*	*35.6*	*6.82*	*−2.3*	*5.341*
P3522	*32*	*16.9*	*3.70*	*6.32*	*−9.5*	*1.070*
P3502	*5*	*2.65*	*0.39*	*6.51*	*−6.7*	*0.172*
P3491	*4*	*2.12*	*0.87*	*6.96*	*−0.3*	*0.147*
Total	***189***	***100***	***40.9***	***–***	***−3.6***	***6.730***

* As compared with the national average for 2012-13 (6.98 t/ha).

In addition to these 189 CSISA farmers, another 500 farmers benefited indirectly via 12 farmer field days (collaboratively held by CSISA-BD and Petrochem), from which they gained knowledge about quality hybrid maize seed and best production practices for maize.

3.1.3 Farmers' awareness of new varieties/management practices (Sub IR 1.3)

Farmers' awareness of new varieties and technologies is raised from training exercises that involve formal village-level training, practical demonstrations of the application of new technology, farmer field days in which farmers from the village visit demonstration plots to see the results of the application of new technology, and exchange visits in which farmers travel to another village to see demonstrations. This section presents results from demonstrations, field days, and training events. In many cases, data collected from demonstration plots are used to further verify that the technology demonstrated is superior to the farmers' practice. Demonstrations therefore tend also to have a research value and this is reflected in the type of data presented in the following section.

In PY14, CSISA-BD trained 36,898 farmers (26,819 farmers new to the program this year), conducted trials and demonstrations with 14,424 farmers, and, through participation in training, trials, and demonstrations, benefited 36,119 rural households (26,276 new households). This brings the total number of households that have benefited directly from the core project (excluding SRSPD and CSISA-MI activities) to 68,648

Rice

Table 9. Demonstrations on rice production.

Demonstration titles	*Number of demonstrations*
Crop management demonstrations	
GAP (584), Rice Crop Manager (368), AWD (341) demonstrations	*1,293*
Direct-seeded aus rice	*10*
Rice variety demonstrations	
New rice varieties: boro (387, short-season aman (397), aus (206)	*990*
Stress- tolerant varieties: submergence (1,051), salinity (153), or drought (73)	*1.277*

Aromatic and premium-quality rice varieties	*668*
Rice varieties for rice-fish gher system	*226*
Cropping system demonstrations	
Rice-mustard-rice	*4,874*
Rice-sunflower-fallow	*1,264*
Rice-sesame, mustard or wheat-mungbean or jute	*341*
Total	***10,943***

Crop management demonstrations for increased rice production

Good agronomic practices

Training in ten good agronomic practices that include good choice of variety and seed source, seedbed preparation, correct spacing, transplanting in lines, weed control, irrigation, and the use of Rice Crop Manager (RCM) to apply the correct fertilizer rates forms the basis for all training given to farmers on rice crop production. A total of 11,520 farmers received GAP training this year. Demonstrations of these GAP show that rice yield can be improved by 10% to 15% when farmers apply these methods.

Alternate wet and dry (AWD) irrigation demonstrations

Providing rice with the correct amount of irrigation water at the right time ensures that crop yield is maximized and that water is not wasted. One way of doing this is to monitor groundwater levels and irrigate when water drops below 15 cm from the soil surface. This can be measured by measuring the depth of water in a plastic tube placed vertically in the ground. This system, called *alternate wet and dry* (AWD), was demonstrated to 341 farmers in 18 irrigation blocks. The system saved three to five irrigations out of a total of 28 to 30 required to irrigate winter-season boro rice, raised grain yield by 5%, and saved farmers $8 to $150/ha in irrigation costs.

New rice varieties

Aromatic rice variety demonstrations

As the economic wealth of Bangladesh increases, a growing demand for high-quality, high-value aromatic and fine-grained Basmati-type varieties has been created. The project has been working on two varieties, BRRI dhan34, a very small-grained highly aromatic aman-season rice derived from the locally grown Chinigura, which is used in festival dishes, and BRRI dhan50, a fine-grained Basmati-type boro variety known as Banglamati. Although the grain yield of BRRI dhan34 is only 3 t/ha, results from demonstrations in four hubs show that, because of the high price of this variety, income from this variety is double that of conventional monsoon-season HYVs.

Initially, millers found BRRI dhan50 difficult to mill and the quantities produced were not sufficient to attract buyers. The milling problems have been resolved and, through demonstrations, the quantity of this variety has increased rapidly. This year, 206 demonstrations have been established, resulting in 1,539 CISA-BD farmers producing 1,230 tons.

Demonstrating rice varieties that will grow in stress-prone cropping environments

Submergence-tolerant varieties

In years with high rainfall in the monsoon season and in areas with a slightly lower elevation, flooding can result in short-statured HYVs being submerged for up to 2 weeks or more. Under these conditions, most rice varieties will not survive or will have severely decreased grain yield. IRRI has been able to transfer a gene, called the *SUB1* gene, into HYVs of rice that gives rice

tolerance of up to 14 days' submergence. In the 1,051 demonstrations conducted this year, the variety with this gene (BRRI dhan52) gave a yield that was either the same (mean of 243 farmers) in Jessore to 24% more than that of the best alternative HYV in Barisal and Faridpur.

Varieties for saline soils

Soil salinity largely occurs during the dry season and in the coastal districts of Barisal and Khulna divisions. If breaks occur in the rainfall in the monsoon season, the soils may become saline as they dry, thus damaging sensitive varieties. A total of 152 demonstrations of saline-tolerant rice varieties were conducted in aman and boro seasons and 226 demonstrations were conducted in saline rice-fish ghers. Hybrid rice is often grown in these ghers but these demonstrations and trials to be discussed later show that the best self-pollinated variety, BINA dhan10, gave a similar grain yield (5.26 t/ha) to that of hybrids (5.35 t/ha) and 9.3% higher yield than that of the standard self- pollinated variety BRRI dhan28.

Increased productivity of the aus rice crop

Aus rice is a rice crop that is established under premonsoon rain and harvested in July or August in time for the transplanting of monsoon, aman-season rice. It offers farmers the opportunity to obtain a second crop of rice either in addition to or instead of dry-season crops. Following on from the results of variety trials conducted in 2013, the project conducted 112 aus rice demonstrations in 2014 comparing locally grown aus rice with three varieties, BRRI dhan55, BRRI dhan48, and BRRI dhan42. These consistently produced a grain yield 0.87 t/ha (21%) more than that of locally grown varieties and they matured within 105 days of sowing, some 2 weeks earlier than locally grown varieties.

Cropping Intensification

A key factor in using dry-season fallow is the introduction of early-maturing monsoon-season rice varieties, mainly BINA dhan7 and BRRI dhan49, 56, and 57, thus allowing the earlier planting of winter-season (rabi) crops.

The use of early-maturing monsoon-season rice varieties has been demonstrated in 397 demonstrations and in 6,479 cropping system demonstrations.

Rice-mustard-rice cropping system

By replacing traditional late-maturing aman rice varieties with varieties that mature 30 days earlier such as BINA Dhan 7, it is possible to grow an 80-day oil seed mustard crop between the aman and boro rice crops. Data from the complete cropping system were collected from four hubs and they showed that total rice equivalent yield was between 14.0 and 15.5 t/ha from rice- mustard-rice cropping systems, between 22% and 46% higher than the rice yield from the current two-rice crop systems, and gave between $624 (27% increase) and $740 (64% increase) per hectare more income (monsoon rice followed by winter rice) (Fig. 5).

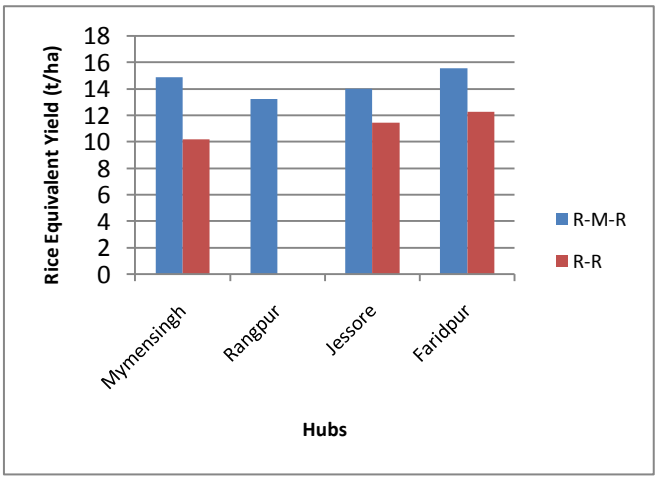


Figure 5: Results of Rice-Mustard-Rice and Rice-Rice Cropping System

Aman rice-sunflower

In many areas of coastal Bangladesh, dry-season soil salinity prevents farmers from using this land for crop production between December and June. Over the last two years, production of sunflower, which has some tolerance of soil salinity, has been shown by the project to be a profitable way of using this land.

As with other crops, early planting is critical to successful sunflower production, allowing the crop to use residual moisture from monsoon rains and escape early monsoon-season storms and rising soil salinity. A relatively low-cost and rapid way of establishing the crop has been found to be dibbling seed into rice stubble soon after the aman rice crop harvest (Fig. 6). This year, 407 farmers in the Khulna hub have used this method for planting sunflower.

Data collected from 150 demonstration plots where farmers dibble planted and 90 plots where farmers plowed before planting showed that differences in yield (2.29 to 2.39 t/ha) and profit ($711 to $693/ha) between the two planting methods were not significant.

Fig. 6. Dibble-planted sunflower emerging through thick rice stubble mulch in Bagerhat

Aman rice-sesame

This high-value, moderately salt-tolerant oil seed crop is grown on saline soils by broadcasting onto plowed land in February. The use of PTOS direct-seeding equipment would allow farmers to plant this crop much earlier, thus avoiding damage by premonsoon rains and taking advantage of residual monsoon soil moisture. This technique was demonstrated on 48 demonstration plots and showed that the earlier planted direct-sown sesame gave 70% more yield (0.93 t/ha) and a profit ($314/ha) that was three times that of the late February-early March broadcast-sown sesame.

Rice-sesame-mungbean and rice-lentil-mugbean cropping systems

In Jessore hub, where there is the most potential for growing grain legume crops in intensive cropping systems, 228 farmers participated in demonstrations of cropping systems that used grain legumes as part of a rice-based cropping system (Table 10). The aman rice varieties grown were early-maturing varieties. Rice-lentil-mungbean systems produced rice equivalent yield of 14.6 t/ha, 41% more than aman rice–boro rice systems, and were five times more profitable.

Table 10. Mean yield and income from five cropping systems (data mean of 18 randomly selected farmers for each cropping system).

Name of cropping pattern	Aman (t/ha)	Mustard-lentil (t/ha)	Boro-sesame-mungbean (t/ha)	Rice equivalent yield (t/ha)	Product-ion cost ($/ha)	Gross return ($/ha)	Gross margin ($/ha)
Rice-lentil-mungbean	5.67	1.52	1.51	14.57	1,827	3,736	1,909
Rice-lentil-sesame	5.65	1.50	1.11	12.16	1,641	3,209	1,568
Rice-mustard-mungbean	5.33	1.14	1.45	11.71	1,750	3,087	1,337
Rice-mustard-sesame	5.23	1.16	1.09	9.46	1,526	2,508	982
Rice-rice	4.72	0	5.61	10.33	2,051	2,422	371

Farmer training and farmer field days

Table 11 lists the farmer training and farmer field days provided on rice production.

Table 11. Farmer training and farmer field days (FFD) on rice production

Interventions	*Training of farmers*		*FFDs/EVs*
	Total farmers	*Women (%)*	*No. of participants*
Crop management training			
Good agronomic practices (GAP)	*11,520*	*18*	*4,346*
Nutrient Manager			*246*
Improved seed storage system			*114*
Mechanization (reapers, weeders, planters, direct-seeded rice)			*403*
AWD (alternate wetting and drying)			*454*
Sunflower value chain			*150*
Variety training			
Favorable ecosystem rice varieties	*143*	*4*	*4,012*
Short aman rice cropping system	*2,780*	*11*	*7,262*
Stress- tolerant rice varieties			*1,797*
Aromatic and premium-quality rice			*902*
Total	***14,443***	***33***	***19,686***

Maize and wheat

Table 12 presents data for several key interventions implemented by the CSISA-BD maize and wheat program under IR1 (On-farm productivity increased). Throughout 2013-14, more than 1,100 on-farm demonstrations were conducted and 5,293 farmers trained (18% females) under these interventions alone.

Table 12. Selected Year 4 maize- and wheat-based interventions for increasing on-farm productivity

Interventions	Training of farmers			Demonstrations		FFDs/EVs
	Year 4 target	Achieved	No. of women	No. conducted	Area (ha)	No. of participants
Maize for income generation and human consumption	2,645*	2,612*	600*	200	27.8	1,332
New stress-tolerant and rust-resistant wheat varieties	450	721	207	174	23.3	1,412
CA demonstrations	180	103	20	48	6.1	251
Intercropping different economic crops with maize	270	214	36	167	9.4	200
Increased production and supply of quality wheat seed	240	246	57	100	13.7	237
Best practices for cereal-based cropping systems	900	1,397	25	414	45.6	557
Total	**4,685**	**5,293**	**945**	**1,103**	**126**	**3,989**

* Includes refresher training that targeted 1,615 farmers; with 1,470 achieved, of which 360 were women.

Intercropping vegetables with maize: a very profitable system ready for scaling up

Maize is grown optimally with 20-cm plant spacing and 60-cm row spacing. The wide spacing of the latter is conducive to profitably growing different intercrops such as short-duration leafy vegetables, legumes, potato, and cruciferous vegetables (Fig. 7). Thus, in the past two years, CSISA-BD staff in selected hubs have been testing and promoting this sustainable cropping intensification technique. Mymensingh and Rangpur hubs have focused on intercropping leafy vegetables (red amaranth, spinach, coriander, and mustard) with maize, while Jessore hub has worked on intercropping garden pea and bush bean with rabi maize, as well as mungbean with summer (kharif) maize.

Fig. 7. Maize intercropping demonstration

Rangpur hub trained 125 farmers (four batches) on intercropping leafy vegetables with maize in rabi season 2013-14; four demonstrations were subsequently established in 21 farmers' fields. Farmers grew red amaranth, spinach, and coriander with maize. Farmers obtained 1 ton more yield from intercropped maize (9.24 to 9.34 t/ha) than their neighbors who cultivated sole maize (8.12 t/ha). In terms of maize equivalent yield (MEY), coriander + maize showed the highest yield (12.13 t/ha), followed by spinach + maize (11.39 t/ha), red amaranth + maize (10.89 t/ha), and sole maize (8.12 t/ha), respectively.

In terms of economics, the gross margin obtained by the demonstration farmers was BDT 95,118/ha from amaranth + maize, BDT 93,689/ha from spinach + maize, and BDT 112,334/ha from coriander + maize. In comparison, the control farmers that produced sole maize had a gross margin of BDT 51,812/ha.

The results of eight demonstration trials in Mymensingh hub also show that intercropping either red amaranth or spinach with maize is highly profitable—even if they have to plant maize later than the recommended optimal time. The demo featured six treatments: sole maize (SM), intercropped spinach and maize (S+M), intercropped red amaranth and maize (A+M), sole late maize (LM), spinach followed by late maize (S-LM), and red amaranth followed by late maize (A-LM).

Table 13 indicates that the highest maize yield was recorded for SM (12.23 t/ha), followed by A+M (11.67 t/ha). As expected, LM yields were significantly lower than for timely planted crops (whether sole or intercropped), and a significantly higher MEY was recorded for maize intercrops: 16.06 t/ha for S+M and 15.80 t/ha in A+M.

Table 13. Yield and profitability of intercropping leafy vegetables with maize, Mymensingh (2013-14)

Treatment	Yield (t/ha)				BDT/ha			
	Maize	Vegetable	MEY *	Weed biomass	Variable costs	Gross return	Gross margin	Additional profit #
SM	12.23 a		12.23 c	0.95 a	92,404	224,920	132,516	0
S+M	10.81 b	5.25 b	16.06 a	0.83 ab	111,488	288,145	176,656	44,140
A+M	11.67 ab	4.13 c	15.80 a	0.68 b	105,456	282,951	177,495	44,979
LM	7.98 c		7.98 d		89,969	148,759	58,790	0
S-LM	7.75 c	6.25 a	14.01 b	0. 80 ab	112,239	252,558	140,320	81,530
A-LM	8.28 c	4.60 bc	12.88 c	0.7b	106,033	232,809	126,776	67,986
LSD (0.05)	1.08	0.85	1.06	0.18				
CV (%)	10.8	14.18	7.9	22.3				

* Maize equivalent yield.

Over and above sole maize (SM) or sole late maize (LM).

Although the gross return was highest for S+M, the gross margin was slightly higher for A+M because of a lower cost of production (the variable cost of spinach was higher because of its higher seed price). Nevertheless, the gross margins for these two intercrop regimes are roughly the same, approximately BDT 177,000/ha ($2,269/ha). Even after sowing maize at the optimal seeding time, intercropping is still a highly profitable option for farmers at BDT 140,320/ha ($1,799/ha) for S-LM and BDT 126,776/ha ($1,625/ha) for A-LM.

Finally, in Year 4 (2013-14), farmers in Jessore hub participated in on-farm demos and trials in which legumes were intercropped with maize. Data from 51 farmers that cultivated garden pea + maize indicate that they averaged 6.63 t/ha and 9.91 t/ha, respectively, for garden pea and maize. On average, the gross margin for this system was BDT 112,981 ($1,449/ha), which is 100% greater than for a sole maize crop. An additional 15 farmers participated in trials of intercropped garden pea + maize and bush bean + maize vs. a sole maize crop. By adding these legumes to a maize crop, farmers can obtain additional profit of (on average) 213% and 204% for garden pea and bush bean, respectively. Conversely, if maize were the additional crop, the same farmers could increase their profit by 122% over sole garden pea and by 116% over bush bean.

Maize production groups in Barisal hub

Beginning with project Year 2 (2011-12), CSISA-BD has intensively promoted maize as an alternative income-generating option for small farmers in Barisal hub via the formation of maize production groups (MPGs). At that time, 75 MPGs were formed with 2,008 farmers/members; this was the basis for a strategy to develop a "critical mass" of maize farmers in a region without much previous experience with the crop. Through Year 4, there are now a total of 161 MPGs across the six districts of Barisal hub, with an aggregate membership of 4,143 farmers; of this total, 96% produced maize for grain and the remaining 4% produced fresh ears for boiling/roasting. During the 2013-14 rabi season, these MPG farmers of Barisal hub cultivated a total of 433 ha of maize, obtaining an average yield of 5.51 t/ha and an average net profit (gross margin) of BDT 7,244 ($93), or approximately $889/ha, which is 53% more than the farmers of the 75 MPGs that began in Year 2 obtained. Note that the groups exist under 13 maize production and marketing associations that were formed (by representatives from the MPGs) during Years 2 and 3 of CSISA-BD. The MPGs and associations both allow farmers to band together to solve problems, promote their interests, and create linkages with other value chain actors (e.g., seed dealers, buyers).

Results of on-farm wheat demonstrations on conservation tillage technologies in Faridpur hub

Bed planting (BP) and strip tillage (ST) of wheat are promoted for scaling up through on-farm demonstrations that compare them, as treatments, with farmers' own practices as a control. A randomized complete block design was followed that included 16 and 11 replications for BP and ST, respectively, in Faridpur, Rajbari, and Gopalganj districts of Faridpur hub. Two separate demonstrations (one with BP and the other with ST) were conducted in different farmers' plots, and the treatments were as follows: (T_1) BP/ST, plus recommended fertilizer rates [RF]; (T_2) BP/ST, plus farmers' fertilizer rate [FF]; and (T_3) conventional tillage [CT], plus FF.

Results show that the investment in all operational costs, except fertilizer and herbicide use in T_1, decreased with both BP and ST options. Farmers generally use less fertilizer than with recommended rates and they seldom use herbicides. Among all cost items, the cost for land preparation/seeding was remarkably lower in both tillage systems, followed by the cost of irrigation. The cost of seed (imputed) and labor decreased by 19% and 18%, respectively. Generally, farmers broadcast more wheat seed than the recommended rate, but the recommended quantity was sown in-line (120 kg/ha) using BP and ST machines.

The total variable cost is 16% less for T_2 (farmers' fertilizer rate) and 8% less for T_1 (recommended fertilizer rate) when compared with T_3, the farmers' practice (FP). Wheat yield increased by 26% and 28%, respectively, for BP and ST under T_1. Both gross returns and gross margin (GM) are significantly higher when employing the tillage machines—GM increased in the range of 76% to 88% for BP and 76% to 91% for ST, which is a phenomenal impact of these resource-conserving machines. Figure 8 displays cumulative probability curves for GM, which show clear differences between both BP and ST and T_3. Both tillage options for wheat cultivation in Faridpur performed well, but, by using recommended fertilizer rates, farmers were able to obtain greater economic benefits than with their current management practices and tillage technology.

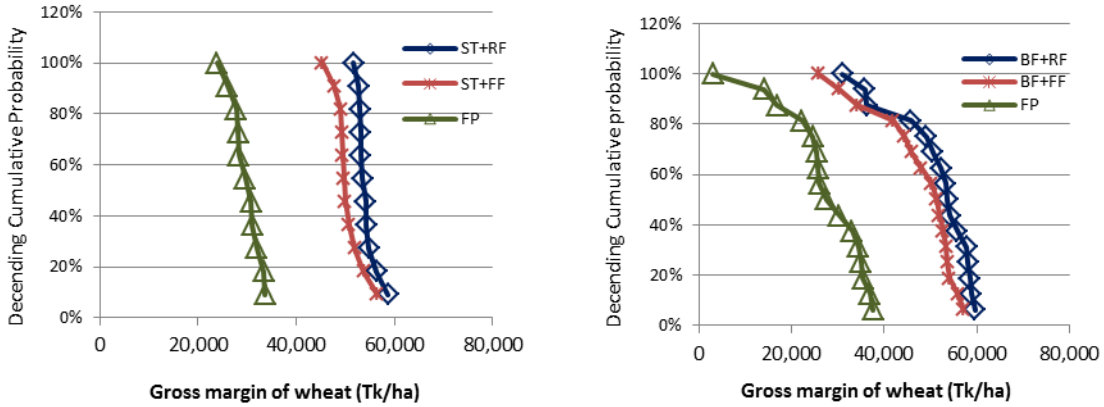


Fig. 8. Cumulative probability curves for gross margin of wheat under strip tillage (left) and bed planting (right) tillage methods, Faridpur hub (2013-14).

Aquaculture

The CSISA-BD aquaculture program introduces new technology through a process involving focus group discussions, the formation of groups of farmers interested in learning about new technology, two-day (total of 10 hours) training, demonstration ponds, and farmer field days (Table 14). Every month, project staff meet with group members to provide them with support and answer questions through a coaching process. Finally, refresher training is given at the start of the next year.

Table 14. Summary of some key aquaculture interventions, targets, and achievements for Year 4

Interventions	Training of farmers			PFTs/demos & trials		LEs/FFDs	
	Year 4 target	Achieved	% Women	No. of participants	Area (ha)	No. of direct participants	No. of indirect participants
Improved pond-based aquaculture technologies	3,325	3,301	21	123	16.89	2,257	5,519
Improved rice field/gher-based aquaculture technologies	1,475	1,352	30	55	12.97	1,074	3,408
Household-based aquaculture and horticulture	850	1,027	100	39	2.20	699	1,853
Total	**5,650**	**5,680**	**38**	**217**	**32.06**	**4,030**	**10,780**

Updates on participatory farmer trials (PFTs)/demonstrations

Harvesting of trials from Year 3 has been completed (the results are presented in Table 15) and 217 Year 4 trials have been established. The results from Year 3 trials show that farmers who apply the technology taught in demonstrations almost double production. Interestingly, the trials also show that, despite the high value of fish, home consumption of fish increased from between 29% for shrimp-based systems and 76% for homestead pond-based systems. This is a clear indication that increased production of high-value products such as fish can be translated into increased consumption by producers.

Table 15. Performance of Year 3 improved aquaculture technologies in PFTs/demos

Technology	Productivity (kg/ha)			Net return (Tk/ha)			Consumption (kg/HH)		
	Endline	Baseline	% increase	Endline	Baseline	% increase	Endline	Baseline	% increase
HH-based pond (n = 43)	4,640	1,580	194	308,269	97,439	216	44	25	76
Carp polyculture (n = 77)	4,890	1,710	186	385,906	90,675	326	55	38	45
Freshwater gher prawn and carp (n = 36)	2,220	1,090	104	372,671	87,435	326	35	22	59
Brackish-water gher shrimp (n = 13)	1,180	640	84	167,004	45,630	266	9	7	29
Rice-fish farming (n = 10)	2,670	930	187	145,743	37,724	286	58	21	57

Farmer training

In Year 4, 5,680 new farmers (38% women) attended a two-day training course on improved aquaculture-agriculture technologies (Table 16). The project provided a total of 227 courses. Each course included sessions on appropriate horticulture models along with nutrition and gender awareness. In some courses, DOF personnel were invited as resource persons.

Table 16. Summary of farmer training on aquaculture in Year 4

Technology	No. of batches	No. of men	No. of women	Total
Improved carp-tilapia and/or pangas polyculture in ponds	6	155	0	155
Household-based pond aquaculture and horticulture for family nutrition and income	41	0	1,027	1,027
Improved carp polyculture in ponds and horticulture on dikes	106	2,069	579	2,648
Improved carp-shing polyculture in ponds and horticulture on dikes	6	132	19	151
Improved farming of freshwater prawn and carp in ponds and horticulture on dikes	2	19	31	50
Improved farming of freshwater prawn and carp in freshwater ghers and horticulture on dikes	31	489	284	773
Improved farming of tilapia in freshwater ghers and horticulture on dikes	3	64	11	75
Improved farming of tilapia in ponds and horticulture on dikes	12	219	78	297

Improved rice-fish farming with dike cropping	10	210	45	255
Improved shrimp farming by stocking PCR-tested PL in brackish-water ghers	10	179	70	249
Total	**227**	**3,536**	**2,144**	**5,680**

Refresher training for fish farmers

Farmers who participated in CSISA-BD activities in Year 3 received refresher training in Year 4. This provides an opportunity to respond to problems faced by farmers when implementing technologies learned in the first training course and to determine the extent to which they have been able to adopt the new technology. During this reporting period, 212 refresher courses were conducted with 5,310 participants, 42% of which were women farmers (Table 17).

Table 17. Summary of refresher training for fish farmers in Year 4

Technology	No. of batches	No. of men	No. of women	Total
Improved carp-tilapia and/or pangas polyculture in ponds	9	217	15	232
Household-based pond aquaculture and horticulture for family nutrition and income	47	0	1,169	1,169
Improved carp polyculture in ponds and horticulture on dikes	75	1,446	421	1,867
Improved carp-shing polyculture in ponds and horticulture on dikes	7	131	26	157
Improved farming of freshwater prawn and carp in ponds and horticulture on dikes	2	24	25	49
Improved farming of freshwater prawn and carp in freshwater ghers and horticulture on dikes	33	555	279	834
Improved farming of tilapia in freshwater ghers and horticulture on dikes	4	71	40	111
Improved farming of tilapia in ponds and horticulture on dikes	14	289	68	357
Improved rice-fish farming with dike cropping	9	194	37	231
Improved shrimp farming by stocking PCR-tested PL in brackish-water ghers	12	168	135	303
Total	**212**	**3,095**	**2,215**	**5,310**

Coaching for fish farmers

CSISA-BD has designed this extension approach to help trained farmers keep in touch and gain advice while actually implementing their learnings. These sessions are held mainly at the site of the participatory trial (PFT) pond. Farmers have shown keen interest in those coaching sessions as this helps them share experiences, gain further advice, and learn from others about inputs, varieties, and markets. Coaching sessions have been provided to Year 4, Year 1, and Year 2 direct farmers. These are usually organized by the partner NGOs, who invite DOF staff members to facilitate some sessions. A total of 549 sessions were conducted in the reporting period, attended by 12,551 farmers (35% women).

Aquaculture linkage events

Linkage events are for value chain actors, NGOs, banks, extension service providers, and farmers. These events provide a platform for displaying and presenting the results from the demonstrations to a large audience that might adopt the technology displayed or invest as market actors. In this period, 180 linkage events have been organized, involving 4,030 direct and 10,267 indirect farmers, 57 GoB officials, 322 market actors, and 123 NGO staff members.

Best Fish Farmer Awards

In 2013, 19 CSISA-BD farmers received "*Best Fish Farmer Awards*" on the occasion of "*National Fish Week*" from the Department of Fisheries. In 2014, 63 CSISA-BD farmers were given these awards (Fig. 9). These are made in recognition of the contribution these farmers have made in improving aquaculture productivity on their own farms as well as sharing and disseminating their knowledge to neighboring farmers. It is especially notable that 20 among these 63 award winners are women. These awards recognize the contribution CSISA-BD has made to the development and dissemination of aquaculture technology in Bangladesh.

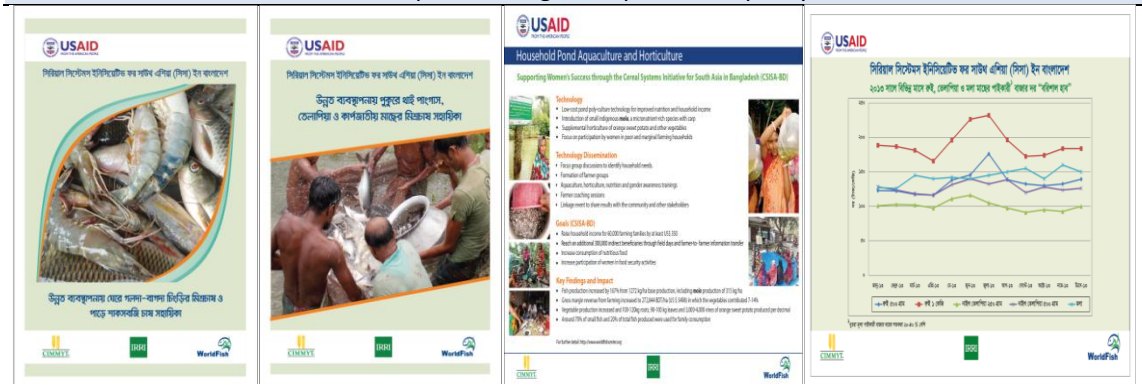
Fig. 9. A woman farmer receiving an award from Honorable Minister Mr. Amir Hossain Amu.

Development of training materials

Farmers' guidebooks, posters, and a market price guide (Table 18) for farmers and extension staff were developed by the project during the year.

Table 18. Training materials printed

Sl. No.	Item	Copies
1	Farmers' Guidebook on Improved Golda-Bagda Polyculture in Gher and Horticulture on Dike	1,000
2	Farmers' Guidebook on Improved Pungus-Tilapia and Carp Polyculture in Pond	3,000



Mechanization (CSISA-MI)

To orient farmers on the use of different agricultural machines promoted by the project, CSISA-MI continued its partnership with Agricultural Advisory Services (AAS) and organized 150 video shows that doubled as hands-on machinery training in 16 districts within the project area. An impressive 25,835 people attended video shows. A study associated with this program showed that farmers learned much more from watching a video than from receiving a leaflet. This is an important finding, which indicates that extension projects should devote more time to preparing and using videos as a vehicle for technology transfer.

CSISA-MI trained 5,840 farmers and 1,078 LSPs, government staff, and private sector actors on agricultural machinery and conservation agriculture. In addition, 276 entrepreneurs received business development services training organized by CSISA-MI.

SUCCESS STORY

Bed-Planted Maize in a New Cropping Pattern: New Hope in Bijly's Life

CSISA-BD provides significant training and knowledge on conservation agriculture-based crop production that is changing the lives of many farmers in northern Bangladesh.

Photo: CIMMYT/CSISA-BD project

"I am happy with CSISA-BD activities and pray for a long life of this project."

Bijly Begum, maize farmer of CSISA-BD, Rangpur hub

Bijly Begum is a poor farmer of Gokunda Village (Lalmonirhat District). She and her husband own 27 decimals (0.11 ha) of land, and share-crop an additional 54 decimals. She is directly involved with crop production while her husband attends to his vegetable trading business. Bijly had always followed a rice-rice cropping pattern, but was plagued by poor income resulting from low yields and the high cost of irrigating boro rice. But this all changed after she was selected for training on conservation agriculture-based maize production offered by CSISA-BD, Rangpur hub.

Because of an illness during the time of the training (prior to the 2013-14 rabi season), Bijly's husband attended on her behalf and later shared his training knowledge with her. At the time of crop establishment, she spent only BDT 192 ($51/ha) to direct-seed maize on 12 decimals of land using a bed planter, whereas she would have spent nearly three times as much ($132/ha) on conventional tillage (plowing three to four times). Initially, however, Bijly and her husband were doubtful of a crop being planted without any thorough tillage of the soil. Her husband even proposed destroying the maize and replacing it with boro rice, until staff from CSISA-BD and partner NGO Solidarity convinced them to stay the course. Later, they regained their confidence when observing that their crop condition was better than that of neighboring farmers who used conventional practices. After that, CSISA-BD was able to get her to try establishing jute as a relay crop with maize; jute seed was sown manually one month before the harvesting of the maize crop. Thus, in the end, her plot cropping pattern became rice-maize-relay jute instead of rice-rice.

Bijly obtained 452 kg of maize from 12 decimals (9.2 t/ha) and sold grain for BDT 6,990 ($1,845/ha) against production costs of BDT 3,390; her net profit was BDT 3,600 ($950/ha). Previously under boro rice, her net profit of BDT 1,600 ($422/ha) had been less than half of that with maize. In addition, she earned extra money from selling jute fiber for BDT 5,900, which was sown as a relay crop with maize; she therefore earned a total net profit of BDT 6,722 from her 12 decimals ($1,774/ha) from maize and jute. She invested part of her profit in her husband's business and also used part of it for household food purchases.

By using conservation agriculture principles and a new cropping pattern, Bijly earned more than four times the net profit from the same land. She is now fully faithful to these new technologies after an initial reluctance: prior to crop establishment, she had planned to cultivate maize with a bed planter on 30 decimals of land. But she was scared of this new technology and decided at the last minute to establish maize using the bed planter on only 12 decimals instead of 30.

Later, she realized her wrong decision when she observed such a great yield with lower production costs. Now, she is fully convinced with this new technology—she has seen with her own eyes that farmers can save both time and money, and increase their cropping intensity, by adopting the technologies and practices promoted by CSISA-BD. As such, she is planning to cultivate maize and jute as a relay crop with maize on 50 decimals of land in the coming 2014-15 season.

3.1.4 Improved agricultural technologies available to farmers (Sub IR 1.4)

In this section, the results of on-farm trials conducted with farmers to validate and verify that new technology will work when used by farmers are presented.

Rice

During the reporting period, the project conducted 1,128 rice system-related on-farm field trials. See Table 19 for more details.

Table 19. On-farm farmer participatory adaptive trials under CSISA-IRRI in Year 4

Adaptive research trials	*No. achieved*
Crop management technology	
Unpuddled boro rice after mustard	*126*
Time of planting and direct seeding trial: sesame (91) and sunflower (21)	*112*
Evaluation of Rice Nutrient manager	*55*
Rice transplanter trial	*11*
Variety trials	
Evaluation of new rice varieties for favorable ecosystems (aman, boro, and aus)	*88*
Stress-tolerant varieties: salinity (471) and submergence (61)	*532*
Short-season aman rice variety	*31*
Aromatic rice varieties (aman)	*19*
Fertilizer × variety trials	
Fertilizer rates and rice variety: ghers (65) and nonghers (48)	*113*
Screening of local aman varieties and N management	*20*
Weed and fertilizer management trials: weeds (3) and fertilizer (18)	*21*
Total	***1,128***

New high-yield rice varieties for favorable ecosystems

Fig. 10. Aman-season rice variety trials, Jessore

Monsoon (aman) season

The focus for variety selection during the monsoon (aman) season is on early-maturing varieties (Fig. 10). Three early-maturing, 110-day varieties (BRRI dhan56 and 57 and Bina dhan7) and one medium-maturing, 135-day variety (BRRI dhan49) were compared at 104 farmer-managed trial sites in four hubs with locally grown 145-day varieties. Mean site grain yield ranged from 3.5 t/ha in Barisal District to more than 6 t/ha in Jessore District. The yield penalty from growing early-maturing varieties was generally close to zero or not more than 10% yield loss. Farmers usually preferred BRRI dhan56 and 57 as they are fine-grain types and cook well. Bina dhan7 gave the highest grain yield among the early-maturing types but produced stickier rice when

cooked. BRRI dhan49 produces a high yield and is very popular with farmers in areas where land fails to drain before mid-November. This variety, however, is quite susceptible to false smut.

Winter (boro) season

In 2013, BRRI released four new varieties suitable for boro-season cultivation. BRRI dhan58 was considered to be a replacement for the widely grown BRRI dhan28 and BRRI dhan60 a replacement for BRRI dhan29. The project compared these four varieties and two other new varieties, BRRI dhan50 and BRRI dhan55, at 16 locations in all six hubs. Grain yield was generally in the range of 5 to 6 t/ha. BRRI dhan58 usually had a similar grain yield as BRRI dhan28 and all other varieties tested. BRRI dhan60, however, had between 18% and 20% higher grain yield in Rangpur, Mymensingh, Khulna, and Faridpur than BRRI dhan28 and 29.

Evaluation of salt-tolerant varieties

Aman season

New salt-tolerant varieties BINA dhan8, BRRI dhan53, and BRRI dhan54 had a grain yield similar to that of the commonly grown 150-day saline soil-tolerant BRRI dhan41 in saline-prone areas of Barguna and Khulna but matured about 3 weeks earlier than BRRI dhan41.

Boro season

A trial in Khulna District compared the response of saline-tolerant and nontolerant varieties to fertilizer under low, medium, and high saline conditions. The low- and medium-salinity sites had similar levels of salinity. The high-salinity site had a salinity level similar to that of the other two sites at the seedling stage but increased to 8.8 ECe dS/m 90 days after transplanting compared with 5.8 ECe dS/m for the low-salinity site (Fig. 11). The grain yield of the salinity-sensitive variety BRRI dhan28 at the high-salinity site was half that of the grain yield at low- and medium-salinity sites.

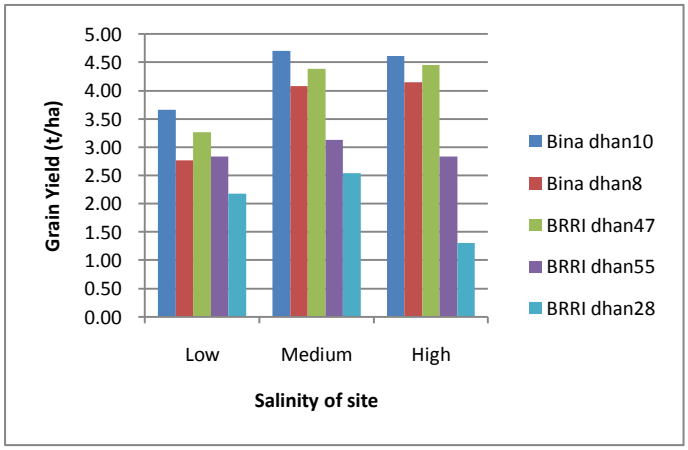


Fig. 11. Grain yield of five rice varieties grown at sites with differing soil salinity levels

A trial in Jessore compared salinity-tolerant BINA dhan8 and 10 and BRRI dhan47 with hybrid rice in ghers at 18 sites. Despite the high price of hybrid seed, poor taste, and low market price, hybrid rice is frequently grown by fish farmers in their gher ponds in the dry season. This is because hybrids have some tolerance of salinity and produce well under the high soil fertility conditions found in ghers. BINA dhan10 had an average grain yield of 7.28 t/ha and the hybrids (Hira5 and SL8H) 7.14 t/ha. Given the higher grain price for the medium-long-grain BINA dhan10 and lower seed cost, this variety had a much higher profit than the hybrids.

Nitrogen application through urea deep placement in local rice varieties

It is estimated that, in coastal Bangladesh, local indigenous varieties are more widely grown than in other parts of Bangladesh. It is thought that this is because of inadequate water management systems and a predominance of low-resource sharecroppers in coastal Bangladesh. Applying small amounts of urea fertilizer as urea supergranules just after panicle initiation might be one way of improving the grain yield of these local tall varieties.

A trial conducted by 72 farmers in Barisal Division, in partnership with BRRI, showed that an application of 30 kg/ha N as urea supergranules at the panicle initiation stage increased rice yield by 0.5–1.0 t/ha. Given the high value of local rice varieties, a 500-kg yield increase would be worth $192/ha. Fertilizer and labor for applying the fertilizer would cost $96/ha, giving a cost-benefit ratio of 1:2.

Evaluation of Nutrient Manager

Adaptive trials in Barisal, Faridpur, and Mymensingh compared rice yield from crops to which fertilizer was applied according to recommendations derived from the web-based *Rice Crop Manager* (RCM) farmer advisory service with the farmers' practice in the aman season. RCM reduced fertilizer cost by $25−53/ha, slightly increased yield, and raised gross margin by $100/ha.

Puddled or unpuddled rice

Experiments were conducted in farmers' fields in all six hubs to determine whether transplanting without tilling would be economical. At all sites, zero-till rice gave lower grain yields than conventionally puddled plots and land prepared with only one pass from a power tiller but without puddling. Yield was lower because of higher weed competition and income less because of higher planting, weeding, and irrigation costs.

Rice-mustard-rice trials

Relay intercropping of mustard over rice. As the aman rice crop matures and standing water under the crop declines, it is possible to broadcast mustard seed over the rice crop. The mustard seed falls onto the mud under the rice crop, where it germinates and establishes before the rice crop is harvested. Trials have shown that this method produces a grain yield that is two-thirds that of conventional tillage methods. Even so, farmers prefer this system as the crop can be rapidly established, resulting in timely transplanting of the following boro rice.

Fig. 12. PTOS-planted mustard, Rangpur

Power-tiller-operated seeder (PTOS)-planted mustard. Sowing mustard directly into rice stubble immediately after the rice harvest using a PTOS without any land tillage is another way of rapidly establishing mustard (Fig. 12). With this system, crops are sown in line, making it easier to weed them. Trials of this system showed that grain yield (1.3 t/ha) in PTOS-sown plots was 30% higher and 114% ($447 ha) more profitable than in broadcast-sown plots. This may be due in part to the much lower weed cover in PTOS plots (2 g/plot 35 days after planting) than in broadcast-sown plots (15.5 g/plot).

Rice transplanter trial. A simple trial comparing plots of BRRI dhan28 winter-season rice (boro) transplanted either by hand or by machine showed that machine-planted plots had a 14% higher grain yield (6.74 t/ha) and, because of the lower cost of hiring a machine compared with hiring labor, 47% higher

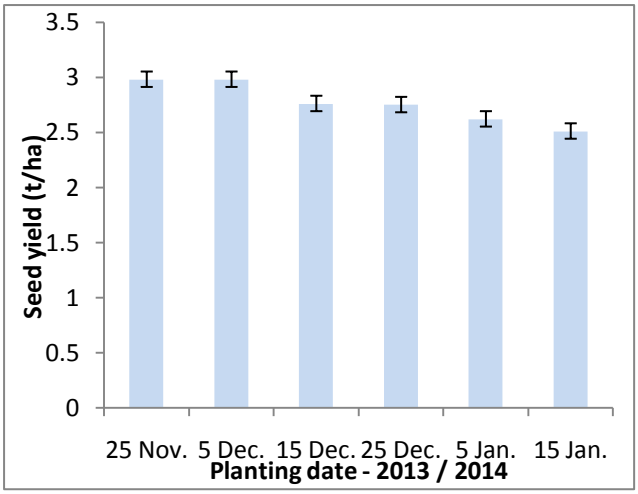


Fig. 13. Yield with time of planting

gross margins ($695/ha) than hand-planted plots.

Sunflower trials

Time of planting

In a trial conducted by farmers in Decope upazilla of Khulna hub, there was a 22 kg/ha grain yield loss worth US$11.40/ha for every day planting was delayed after 5 December until 15 January. Grain yield for January-planted sunflower was still reasonable, indicating that sunflower can be planted late without suffering huge yield penalties (Fig. 13).

Maize and wheat

Participatory adaptive trials on hybrid maize

In 2013-14, the CSISA-BD maize and wheat team conducted on-farm participatory varietal selection (PVS) trials on hybrid maize genotypes with the objective of understanding varietal suitability/adaptability to biophysical and socioeconomic environments. Varieties tested included one from BARI, two from CIMMYT, and several commercial hybrids grown in Bangladesh. The trials took place in the Barisal, Faridpur, Khulna, and Mymensingh hubs.

Between six and nine hybrids were evaluated in the south, depending upon the hub (six in Faridpur, seven in Khulna, and nine in Barisal). The first six hybrids shown in Figure 14 were common to these three locations, and were selected based on their performance in previous years. Of the nine hybrids assessed, two were quality protein maize (QPM) (one yellow-grained and one white-grained) tested on four farms each across the hubs (Khulna, Faridpur, and

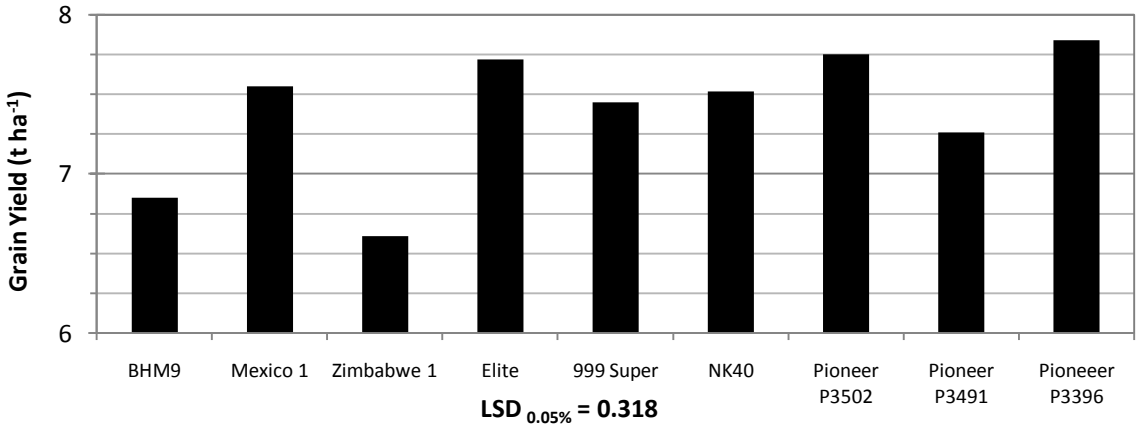


Fig. 14. Yield performance of maize hybrids in multilocation on-farm participatory adaptive trials, 2013-14

Barisal). Note that QPM maize is being promoted for poultry and fish feed, as well as for human consumption (particularly the white-grained variety), specifically because of its lysine and tryptophan content.[3]

As illustrated in Figure 15, varietal yield differences were statistically significant (LSD = 0.318, α = 0.05), irrespective of location, and ranged between 6.61 and 7.84 t/ha. Additional analysis (not shown) indicated an effect of location on yield performance, with the varieties evaluated in Faridpur hub yielding the highest (9.07 t/ha) compared with those in Barisal (6.54 t/ha) and Khulna (6.55 t/ha) hub locations. Interaction effects between the hybrids and location were also found to be statistically significant, indicating that the performance of the tested hybrids across different locations was not consistent.

[3] QPM contains twice the amount of lysine and tryptophan than normal maize varieties; these two essential amino acids are vital for children and pregnant women, and are also good for mono-gastric animals (e.g., pigs, poultry).

A different trial set was examined in Mymensingh hub (four farmers' fields); this set consisted of six hybrids (Titan, Pioneer 30D97, Hira 101, Fortune, Elite, and Miracle). Statistical analysis for grain yield was performed in order to test whether there was a genotypic difference. In Mymensingh, the mean grain yield (12.7 t/ha) was higher than in the other locations in the south. Of the six hybrids, Elite (14.27 t/ha) was observed to be the highest yielding, followed by Titan (13.57 t/ha) and then Miracle (13.22 t/ha), although the differences were statistically insignificant.

Genotype by environment (G × E) interactions for selected hybrids were explored by regressing their mean grain yield against the mean of all hybrids tested from 2012 to 2014 in CSISA-BD maize PVS trials. The means of all hybrids tested from 2012 to 2014 are referred to as the environmental index, and this comprises the X axis in Figure 15. Depicted in the figure are the results of the G × E analysis: BHM9 (R^2 = 0.7155, empty triangles), NK40 (R^2 = 0.6619, filled squares), Mexico 1 (R^2 = 0.8555, filled triangles), and Zimbabwe 1 (R^2 = 0.9182, empty squares). The regression coefficients of each of the four hybrids performed well, because the R^2 values are well above 0.6 and each followed a similar trend under all environments tested (i.e., both good and poor). This nullifies the notion that southern Bangladesh is not suitable for maize. Hence, there exists a tremendous potential to promote maize for system intensification and a great opportunity for farmers in the south to benefit from the cultivation of maize.

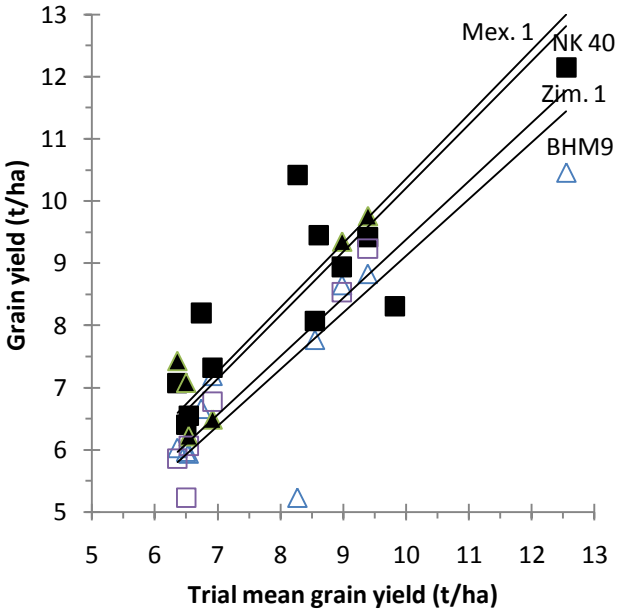


Fig. 15: Grain yield of four hybrids vs. the mean grain yield of all hybrids tested in on-farm PVS trials during 2012-14

Rice-maize system performance under conservation tillage, in rainfed and water-limited environments of southern Bangladesh

In southern Bangladesh, rabi-season water access is limited, with large areas of land remaining fallow as a result, necessitating either year-round rainfed cropping or limited irrigation for rabi production. The challenge is therefore to achieve high and stable yield through profitable crop management practices and rotations that capitalize on soil moisture reserves and sparse irrigation. Rotating maize with rice might comprise part of the solution to this problem. However, little is known regarding what crop management practices are optimal for maize in the south. This research therefore assesses the performance of various tillage systems, including conservation agriculture (CA), in rice-maize rotations in rainfed and water-limited environments in southern Bangladesh.

Farmer-managed (with researcher support) split-plot experiments were started in rabi 2011 with four main-plot factors, which include the following:

T1: conservation agriculture [unpuddled transplanted aman rice (UPTR) and strip-tilled and machine-planted rabi maize, both with 30% rice residue retention (RR)].

T2: mixed tillage (puddled transplanted aman rice (PTR) with 30% rice RR and strip-tilled and machine-planted rabi maize with RR).

T3: full tillage (PTR in aman and single-pass tilled and machine-planted rabi maize; both with no RR).

T4: farmers' practice (PTR in aman, with fully tilled but hand-planted rabi maize, both with no RR).

Trials were conducted in two production environments for two years: two rainfed [Khulna (*n* = 10 farmers) and Patuakhali, (*n* = 5)], and thee limited-irrigation locations [Shatkira (*n* = 10), Patuakhali (*n* = 5), and Barisal (*n* = 5)]. Economic performance was estimated to identify the best tillage and management practices for farmers, for a given environment, in southern Bangladesh (Fig. 16).

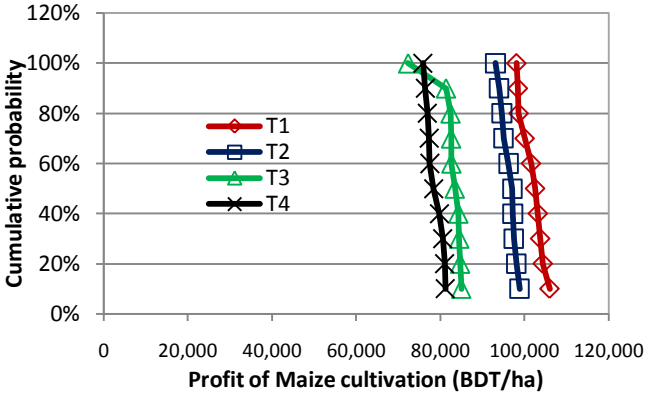


Fig. 16. Cumulative probability for profit of maize under saline soil in irrigated conditions at Satkhira, 2014

Strip-tilled maize whether following puddled or unpuddled rice always gave the highest profit and probability of obtaining the highest profit. This is due to a combination of higher yield and reduced production costs for tillage, resulting in consistently higher profits recorded for T1 and T2 (Fig. 17). Most farmers consequently preferred T2 over T1 for its combination of high yield and increased profit over T3 and T4. Although not "fully CA" because of soil puddling during aman, farmer participants were more interested in adopting T2. This highlights the importance of maintaining a flexible interpretation of what exactly constitutes CA management practice, as farmers should be encouraged to adapt crop management systems to suit their own needs and socioeconomic circumstances.

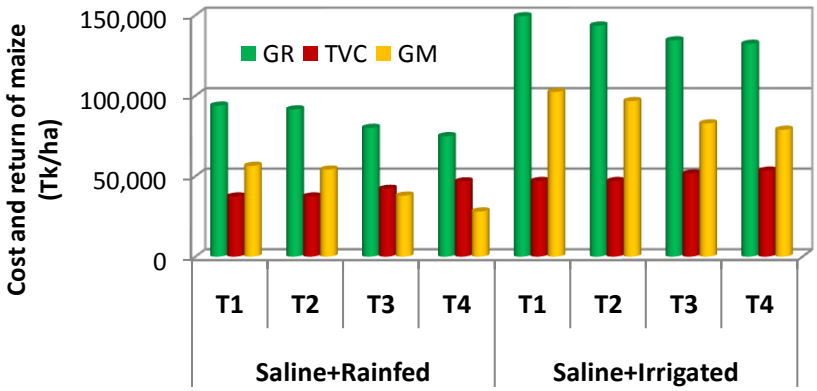


Fig. 17. Profitability of maize cultivation under conservation agriculture in rainfed and irrigated areas under saline soil at Khulna/Satkhira, 2013-14

Aquaculture

During Year 4, the aquaculture component of CSISA-BD completed adaptive research trials started during Year 3 and Year 4. These are summarized below:

Participatory action research by women on improving the productivity of challenged shaded homestead ponds

Ponds either shaded by valuable fruit and timber trees or that are full with water for only part of the year are very common throughout Bangladesh. As production methods designed for this type of ponds have not been developed, it is difficult to provide farmers with advice on the best ways of improving the productivity of this commonly available resource. CSISA-BD therefore began research at eight sites in saline and freshwater agro ecological zones to develop ways of improving the productivity of these ponds. At each site, 12 shaded ponds located close to the

homestead were selected. Three treatments made up of different combinations of tilapia and shade-tolerant fish species were each applied to four of the ponds at each site (three treatments replicated four times). All ponds were harvested in February and March 2014, and initial results showed that a combination of Catla, Koi, Magur, M. carp, Rui, S. carp, and tilapia, producing 1,443 kg of fish per ha, was the best. A woman managed every aspect of this trial from design to data collection and this is an excellent example of what can be done through farmer participatory action research.

Fig. 18. Sampling catfish and climbing perch showing good performance along with tilapia in a shaded pond trial, Barisal hub

Development of low-cost tilapia and prawn feed by using sunflower cake and maize as an alternative source of fish feed to ones based on fish meal

Feed represents the largest expenditure item in semi-intensive and intensive aquaculture systems and protein is the most expensive macronutrient in fish/shrimp feed. Typically, in intensive systems, feed accounts for 60% to 80% of the operational costs. In contrast, in semi-intensive systems, feed and fertilizer use represents 30% to 60% of the total cost of production. Lots of studies have been conducted to evaluate alternative cheap feed supplements for aquaculture that are derived from both plant and animal sources (Fig. 19). Among the large variety of ingredients used in commercial fish feed pellets, fish meal still remains the major dietary protein source for fish feed, comprising 20–30% of the feed. However, fish meal prices have sharply increased globally and, as most fish meal is harvested from wild fish stocks, this also depletes wild fish stocks.

Fig. 19. Tilapia feed trial in a freshwater gher.

As a consequence of high fish feed prices, the majority of smallholder farmers cannot afford to buy commercial feed or prepare homemade feed with the optimal mixture of ingredients. Instead, they feed prawns and tilapia with boiled rice, rice bran, broken wheat, poultry droppings, and mustard oil cake. This type of diet does not meet the nutritional requirements of fish. To help farmers overcome these problems, CSISA-BD Jessore and Khulna hubs are conducting trials to test the efficacy of fish feed formulas made using locally grown crop-derived ingredients.

In recent years, maize and sunflower cultivation has been promoted in southwestern districts. Analysis reveals that maize meal and sunflower oilcake contain significant amounts of protein and are cheaper than other fish feed ingredients. Based on maize meal and sunflower oil seed cake, three aquaculture diets have been formulated for both tilapia and prawns in collaboration with the Bangladesh Fisheries Research Institute (BFRI) and Bangladesh Agricultural University

(BAU). Overall performances of all the feeds are very encouraging but the results of the experiments will not be available until after November 2014 when the fish will be harvested.

Development of year-round vegetable farming technologies on brackish-water shrimp gher banks in southern Bangladesh

Vegetable production on the dikes of freshwater ghers is now common but is seldom possible on the dikes of brackish-water shrimp ghers where soil salinity is high (Fig. 20). CSISA-BD, in Khulna, found that the best combination for the summer rainy season was bitter gourd and yard-long bean or bottle gourd and okra and for the winter dry season sweet gourd and tomato. The trial also found that applying sludge from the bottom of freshwater ghers/ponds spread on the dikes of brackish-water ghers greatly improved production.

Fig. 20. Development of year-round vegetable production in ghers

Trial to determine the productivity of micronutrient-rich small fish, mola (*Amblypharyngodon mola*) and darkina (*Esomus danricus*), grown in combination with carp in homestead ponds

The trial was conducted in Mymensingh and Barisal hubs. Small indigenous fish species contribute a major portion of micronutrients (minerals and vitamins) of high bioavailability to the diets of rural Bangladeshis. Of particular importance are mola (*Amblypharyngodon mola)*, which is rich in vitamin A and zinc, and darkina (*Esomus danricus)*, which is rich in iron and zinc. The productivity of these two species grown in combination with carp was investigated in a trial with six female farmer-managed homestead ponds (average size: 340 m^2). Before the trial began, the total fish production from these ponds was 2,400 kg/ha. After conducting the trial, fish production for the six ponds was 6,317 kg/ha (carp 5,670 kg/ha, mola 332 kg/ha, and darkina 315 kg/ha) in 330 days.

Effect of pond-bottom sludge removal on fish production

There are two kinds of technical constraints to pond fish production: abiotic (e.g., problems with water, soil, temperature, etc.) and biotic (e.g., pests, predators, and disease). Dey et al (2005) estimated the annual financial loss caused by the various biotic and abiotic factors to be $243/ha. They also suggested that abiotic constraints are more important than biotic constraints to freshwater aquaculture development in Bangladesh. One of the main abiotic problems is the deposition of aquaculture sludge in fish ponds. Aquaculture sludge is composed of fish waste and uneaten fish food that settles at the bottom of the fish pond (Birch et al 2010). Aquaculture sludge from freshwater ponds has also been treated by vermicomposting for subsequent use as bio-fertilizer. The nutrient content of sludge fertilizer is superior to that of traditional organic matter (Birch et al 2010).

The objectives of the research are to observe the effect of sludge removal on fish mortality, fish production, and pond water quality, and to evaluate the cost effectiveness of sludge removal in semi-intensive and intensive aquaculture systems.

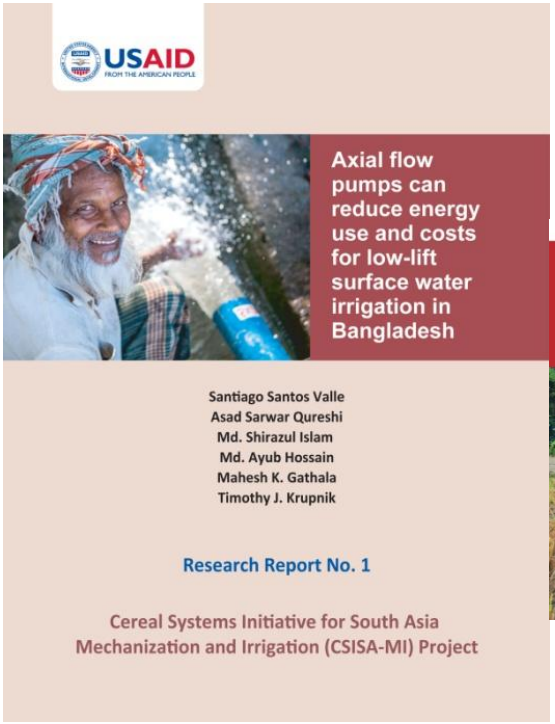
Results are not yet available but initial indications are that the sludge remover works but needs some modifications to make it more user-friendly and that farmers see a benefit in terms of improved pond productivity from removing sludge.

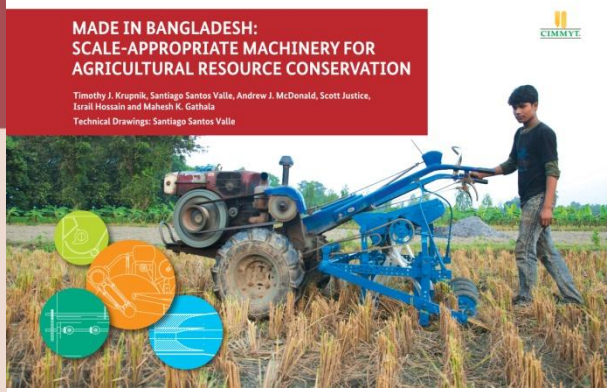
<u>Mechanization (CSISA-MI)</u>

Science-based interventions form the core of CSISA-MI's work. Project scientists are leading on applied research to develop appropriate irrigation and nitrogen regimes for maize grown in the

FtF region. Further research uses remote sensing and GIS to identify the appropriate environments and soils on which bed planters can be used, and where AFPs can be employed to bring dry-season fallow and underused land into crop production. These efforts are combined with applied econometric analyses to identify the factors that influence LSP's investment in agricultural machines and to uncover the predominant structure of irrigation water pricing in southern Bangladesh so that improved business models to facilitate affordable surface-water irrigation can be developed. Additional research considers the trade-offs between crop residue use for livestock and conservation agriculture, and, in partnership with Wageningen University, CSISA-MI is supporting one PhD and one MS student to use advanced crop and farming systems design models to propose solutions to these pressing concerns.

During the reporting period, based on scientific research, the project published a book titled "Made in Bangladesh: scale-appropriate machinery for agricultural resource conservation" and a research report on "Axial flow pumps can reduce energy use and costs for low-lift surface water irrigation in Bangladesh."





SUCCESS STORY

Visit, observe, and learn: the gher system introduction in northwest Bangladesh

Gher farming has proven to be highly successful in the south. CSISA-BD is promoting the adoption of this system with high potential in northwest Bangladesh in a three-pronged approach of visit, observe, and learn.

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Photo: MD NAHIDUZZAMAN, MD SHEIKH FARID WorldFish/ CSISA-BD PROJECT

"The land topography of Jessore and Rangpur is identical and the contexts are quite similar. If the people of Jessore are able to succeed through gher system farming, why can't we? "

Mr. Zoinal Abedin, a gher system farmer, Rangpur

Story: Md. Nahiduzzaman, CSISA-BD

Freshwater gher farming is a unique and dynamic system that integrates three agricultural interventions: fish and/or prawn, high-yielding-variety rice, and vegetables. A gher is a depressed low-lying land confined within raised dikes where alternate forms of rice-fish farming are practiced along with vegetables on dikes. This has been practiced over the years in southern Bangladesh and is expanding rapidly in the coastal regions because of its proven high income-earning potential and for enhancing year-round resilience. CSISA-BD is promoting the adoption of this system with high potential in northwest Bangladesh in a three-pronged approach of visit, observe, and learn.

Rice-fish farming is popular in the low-lying areas of the north, with the general practice being rice-fish followed by boro rice and then fish. Noticing the befitting nature of ghers, CSISA-BD, Rangpur hub, organized an exchange visit for eight farmers to Jessore so as to inspire them to adopt this technology. These farmers volunteered to spend their own money to attend this visit after discussions on ghers at a farmers' meeting. On returning, seven of them are trying out this system.

The northern rice fields provided a similar context for convenient uptake of the gher system. These farmers came back and modified their rice fields by renovating, cutting down the trees, widening the embankments for horticulture, raising fingerlings in the ditch inside their gher, stocking large-sized fingerlings together with grass carp, and keeping records of all activities.

One of the farmers, Mr. Zoinal Abedin, stated, "The land topography of Jessore and Rangpur is identical and the contexts are quite similar. If the people of Jessore are able to succeed through gher system farming, why can't we? We just need to bring about a change in attitude to take up this practice."

Another farmer, Rashedul Islam, said, "I tried before for a bank loan to invest in agriculture but in vain. However, after visiting my gher, the loan officer granted me BDT 500,000 whereas I was earlier refused BDT 100,000.

As a result of this innovation, farmers are able to consume and sell rice, fish, and vegetables from the same piece of land. They gained further confidence from the guidebooks, frequent visits and coaching, text messaging, and calls that the project staff provided. The exchange visit proved to be a powerful tool for enabling technology uptake.

3.1.5 Enhanced research and development capacity (Sub IR 1.5)

Capacity building of stakeholders such as researchers, extension workers, farmers, and service sectors from government agencies, NGOs, and private agencies assists with the scaling out of technology developed and promoted by the project.

CSISA-BD higher education program

Through a $60,000 grant managed by the Bangladesh Agricultural Research Council (BARC), CSISA-BD provided a training stipend to support six government staff to conduct studies and research that will lead to a PhD. A further four students funded in collaboration with IFAD have been conducting multiyear cropping systems trials that will lead to a PhD. Two of the students are based at the Jessore Regional Research Station and two at Patuakhali University of Technology in Barisal Division. The principal findings from these research station trials follow:

Md. Jahangir Alam, BARI Regional Research Station, Jessore: "*Evaluation of conservation agriculture for the rice-based cropping system on the High Ganges River flood plains of Bangladesh.*" The trial compared over three years (nine seasons) a wheat-mungbean-aman-season rice cropping system produced without any tillage (strip-till planting including dry-seeded aman rice) with the same cropping system using conventional tillage methods and with the commonly used aman rice followed by boro rice system. The three-crop system planted without tillage produced a total rice crop equivalent yield of 14.3 t/ha. This was 9.2% more than the 13.1 t/ha produced by the aman/boro rice system and, importantly, this was achieved with only 55% of the water required for the two-rice crop system.

Sarif Ahmed, BARI Regional Research Station, Jessore: "*Effect of application timing of preemergence herbicides on weed efficacy and crop phytotoxicity in dry-seeded rice.*" This trial showed that maintaining plots weed free by hand weeding gave a significantly higher grain yield than that gained from using herbicides. Considering the cost of hand weeding, use of the preemergence herbicide pendimethalin and a single hand weeding was the most economical option.

Nibir Kumar Saha, Patuakhali University of Technology and Science, Barisal Division: "*Triple rice: is it feasible for south-central Bangladesh?*" The trial showed that it was possible to grow three rice crops a year in southwest Bangladesh in an area where it is common for farmers to produce only one crop a year. Total annual yield from the best combination of planting dates and variety was 17.1 t/ha.

Jayanta Bhattacharya, Patuakhali University of Technology and Science, Barisal Division: "*Feasibility of rice-rice-rabi systems for increasing the productivity of low-salinity regions of the coastal zone of Bangladesh.*" This cropping systems trial compared a complex mix of crops and planting dates (see Fig. 21) and clearly showed that the low-salinity areas of the coastal zone of Bangladesh, such as those found in Barisal Division, have a high potential for intensive crop production when water for irrigation is available and flooding is controlled. Under these conditions, it was possible to produce a rice equivalent yield of 19.3 t/ha/year from the best combination of planting dates and crops (5 April-5 July-15 December seeded aus-aman-maize system).

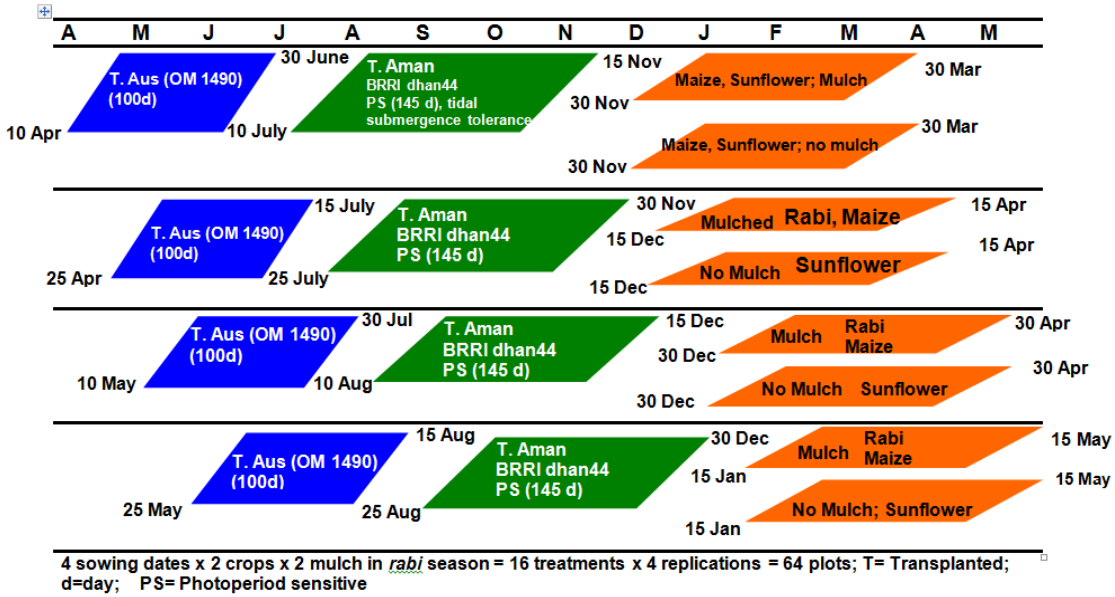


Fig. 21. Crop calendar for aus-aman-rabi cropping system treatment combinations

Maize and wheat

Under CSISA-BD, and in collaboration with BARI, CIMMYT is conducting a research project titled "Achieving and Sustaining Cropping Systems Intensification (ASI) in Prime Environments of Bangladesh." Mr. Muhammad Arshadul Hoque (senior scientific officer, FMP Engineering Division, BARI) was selected to oversee this project while pursuing a CSISA-supported PhD at Bangladesh Agricultural University. The main objective of this trial, which is being implemented at BARI's Regional Agricultural Research Station in Jamalpur, is to investigate energy-use efficiencies and crop productivity of different CA-based crop management options under different cropping systems**.** As a long-term trial, it is also an important platform for demonstrating to research and development leaders (including policymakers) that CA-based crop management works well in Bangladesh.

As part of this research project, Arshadul is modifying the tines/blades of tillage implements to ensure that seed and fertilizer are placed at the appropriate depth and with the proper amount of soil cover. These are critical factors in optimizing the germination potential (and hence improving the overall performance) of both maize and wheat crops sown via strip tillage; finding the proper design for the tines has been an ongoing problem for conservation tillage scientists. His research from the first year of the trial shows that an "inverted-T" furrow opener allows for better seed placement, seed covering, and germination results than the standard Chinese shoe-type furrow opener. Results also suggest that the modified curved (MC) blades with a 15^{o} tip angle provide better furrow backfill than either the standard Chinese blades or MC blades with a 0^{o}, 30^{o}, or 45^{o} tip angle. To validate these results, 10 sets of MC blades and inverted-T furrow openers were distributed for on-farm testing as part of trials conducted by CSISA-BD hub personnel.

Table 20 shows the staff training for wheat and maize program staff and partners in Year 4

Table 20. Staff training for CSISA-BD wheat and maize program staff and partners, Year 4

Description of training	No. trained	% women
Training of trainers (ToT)		
ToT for local-level advanced farmers/SAAOs/project and partner staff on maize and wheat production practices	149	6.7
ToT for government staff on mechanized wheat and maize production systems	82	7.3
Training for project/partner staff and value chain actors		
Project and partner staff training on improved techniques for maize and wheat production and CA machinery operation	119	3.4
LSP development training on CA machinery operation and business development services	718	1.8

Aquaculture

Training on improving seed quality initiative for Department of Fisheries (DoF) officials

In Mymensingh and Rangpur, 49 upazilla fisheries officers and farm managers from the Department of Fisheries (DoF) were given training on fish seed quality (Fig. 22). CSISA-BD has been working with various hatcheries in collaboration with DoF to ensure that quality seed production and distribution adheres to basic genetic principles and hatchery rules and regulations. In a workshop, the participants were updated on these and analyzed the current status of the freshwater fish seed sector in terms of quality seed production constraints and challenges.

Fig. 22. DoF official presenting group work findings in fish seed quality training initiative.

> *"I feel now the importance of applying genetic principles and improved management systems in the hatcheries. We can now monitor the hatcheries effectively, advise them, and we can even include CSISA-BD aquaculture initiatives for quality seed production and distribution in our yearly plans"* – ***Mahfuzur Rahman,*** *senior upazilla officer, DoF, Rangpur*

Capacity-building course on Research Design and Writing Skill Development

CSISA-BD organized a course for 26 aquaculture staff on "**Research Design and Writing Skill Development**" to help them design, analyze, and write reports on trials.

Partner staff ToT on extension methodology and improved aquaculture technologies

To build the capacity of partner extension staff, CSISA-BD organized a 6-day training of trainers course at the Khulna hub for 26 extension staff. It covered the general concept on CSISA-BD,

basic extension and training methodology, and technical issues on aquaculture and horticulture and gender and nutrition.

CSISA-BD also organized a 3-day refresher course for the staff who received ToT in Year 3. A total of 18 previously trained staff attended the refresher course. In this course, participants shared their field experience and received further clarifications.

Capacity building of aquaculture value chain actors on improved aquaculture technologies

The CSISA-BD aquaculture team has conducted a 2-day training course in all six hubs to improve the knowledge and skills of aquaculture value chain actors who are involved with seed, feed, and other aquaculture inputs. A total of 141 value chain actors participated in this course in six batches. This course raised their knowledge about aquaculture technologies and their ability to provide their clients with sound technical advice.

Aquaculture PhD research program

Mr. Subrata Mondal, PhD Fellow, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh; is conducting research on the "Biology and Production of Nutrient-Rich Small Fish Mola (*Amblypharyngodon mola*) and Darkina (*Esomus danricus*) in Rice-field and Pond Conditions." The research program will improve our knowledge of the breeding biology of nutrient-rich small mola and darkina fish from on-station trails carried out at the Field Laboratory at BAU, Mymensingh and from on-farm trail. The study has shown that the mola breeding period is from April-December. Fractional spawning behavior and death of some female mola broodfish within short period after breeding was observed. Darkina fish were found to be multiple spawners, releasing eggs in batches over three months two peaks between June and July and between September and October.

Figure 23: PhD Research Fellow working in BAU Lab

Table 22 Capacity-building activities for public-private partner staff in Year 4

Description of training	*No. trained*	*% women*
Research Design and Writing Skill Development	*26*	*4*
Capacity-building course on extension and aquaculture for partner NGO staff (ToT and refresher course)	*26*	*23*
Refresher course for PNGO staff on extension and aquaculture	*18*	*0*
Training course on Seed Quality Improvement Initiative for Govt. Officials	*49*	*9*
Improved Aquaculture Management Training for Value Chain Actors	*141*	*0*

Development of training materials

Two manuals on fish hatchery management have been developed for hatchery technicians and managers.

Mechanization (CSISA-MI)

CSISA-MI works in close collaboration with a number of private sector and government institutes. CSISA-MI also aims to improve the capacity of the public and private sector to ensure stronger science-led interventions, value chains for agricultural machinery and pumping

equipment, and better services to farmers. As such, CSISA-MI strengthens relationships at the national as well as field level with the relevant government institutes and other partner organizations.

For example, the Bangladesh Agricultural Development Corporation (BADC) is a core CSISA-MI partner. With assistance from USAID, CSISA-MI staff worked with BADC to develop a $1.5 million project that focuses on boosting BADC's ability to clean and rehabilitate irrigation canals to facilitate surface-water irrigation in the Barisal region. The project was approved by the Bangladeshi government in June 2014 and will excavate 72 km of canal systems and install sluice gates in strategic locations in collaboration with CSISA-MI's engineers and irrigation scientists. Following rehabilitation, CSISA-MI plans to help farmers use the extra freshwater reserves created through this work by facilitating the provision of axial flow pump irrigation services by local service providers.

CSISA-MI has also been collaborating with the extension staff of the Department of Agricultural Extension (DAE) throughout the FtF zone. CSISA-MI has oriented DAE staff on the use of surface-water irrigation and advanced agricultural machinery, and formalization of this partnership is expected in the next year. In addition, CSISA-MI continues to collaborate with the Bangladesh Agricultural Research Institute (BARI) to test and refine two-wheel tractor-based agricultural machinery and irrigation pumps. Importantly, CSISA-MI is facilitating the testing of new domestically produced AFP prototypes at BARI for quality control assurance.

3.1.6 Increased use of enhanced agricultural services (Sub IR 1.6)

To drive more precise and resource-conserving agriculture through precision equipment, CSISA-MI currently promotes four keystone technologies: the fuel-saving axial flow pump (AFP) for surface-water irrigation; bed planters and seeder-fertilizer drills that can be used for line-sowing and conservation agriculture, and the bed planters help to save farmers on irrigation water volume and cost; and reapers that address labor bottlenecks at harvest and speed up the time between harvest and the planting of the next crop. These machines help boost yields by maximizing the productive use of soil moisture, fertilizer, and seed, while saving farmers' time, labor, and money. Through public-private partnerships with machinery manufacturers and importers such as Advanced Chemical Industries (ACI) and Rangpur Foundry Limited (RFL) Group, CSISA-MI is working to commercialize and catalyze the wide availability of these machines for LSPs in the FtF zone (Fig. 24).

SUCCESS STORY

Seeder replacing traditional farming

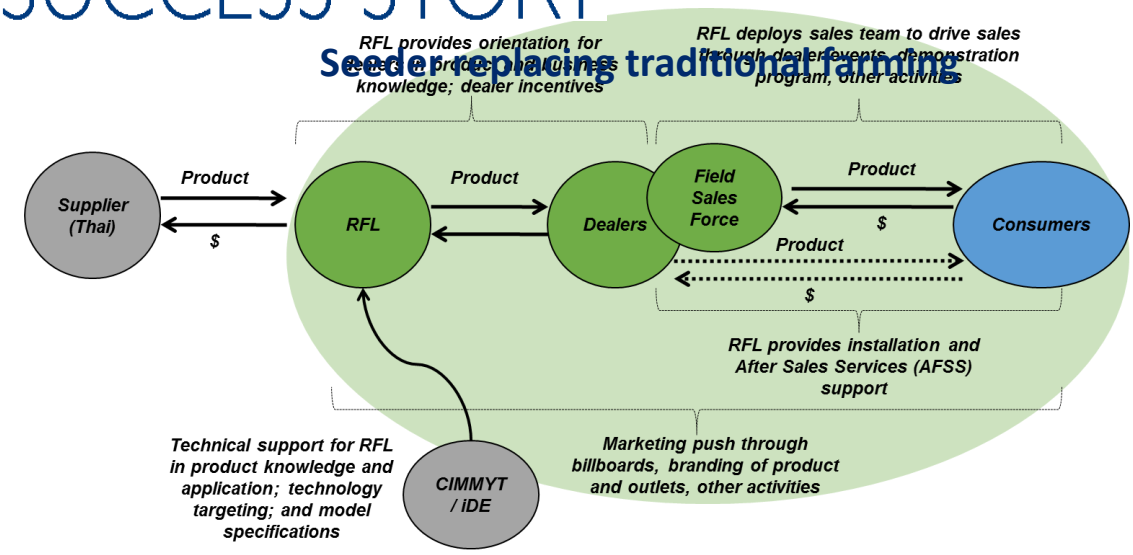


Fig. 24. CSISA-MI business model with RFL to promote the axial flow pump

To scale up agricultural machinery planting, fertilization, and harvesting services, CSISA-MI employs a strategy similar to that of SO1. CSISA-MI is also working to analyze the market and the response of LSPs to agricultural machinery demand from farmers. This is currently being enhanced through our approach to human-centered design (HCD), whereby bed planters are being redesigned by a team of agronomists and engineers to improve the form, fit, and function of the machine and to make it a more appealing product for marketing by ACI. As such, CSISA-MI's commercialization approach plays a temporary and catalytic role in the development of a scalable machinery service provision model that is designed for sustainability, and built to continue to function beyond the duration of the project.

3.1.7 Private sector service provision of agricultural machinery (Sub IR 1.7)

To facilitate a rapid adoption of surface-water conveyance equipment, including fuel-efficient AFPs, in the FtF zone, CSISA-MI works through market channels. This commercialization approach is based on "Markets for the Poor," or M4P theory, and has a two-tier focus: (1) opening the market for water conveyance services by creating a space for the water pumping equipment and (2) introducing LSPs to farmers to facilitate the use of surface water for agricultural purposes. LSPs are in turn both customers for pump purchases and service providers for farmers. CSISA-MI also offers support to private sector partners such as RFL, to facilitate the movement of pumps through the value chain to farmers. By developing an attractive business proposition around the AFP and related surface-water pumps, CSISA-MI encourages LSPs and farmers to adopt the productive use of surface water within existing farmer practices. Critically, CSISA-MI works to layer these interventions with other actions to allow farmers to intensify dry-season cropping, including input provision, training on best-bet irrigation management and agronomy, and access to credit. The latter is particularly critical. As part of developing targeted financial services to support the supply chain for agricultural mechanization products, CSISA-MI signed an MoU with Jagaroni Chakra Foundation (JCF), a microfinance institute, to ensure that LSPs have easy access to small-scale and low-interest loans for the purchase of reaper machines. CSISA-MI expects to expand the portfolio of micro-credit providers in Year 2 to cover other machines.

Even nine months back, Nishikanta Mandal, 59, of Baliakandi upazilla, Rajbari, was not affluent enough to meet his children's needs. But, the scene started to change when he purchased a seeding machine.

Photo: SHIRIN/CSISA-MI

"With fuel cost of BDT 150 (US$1.93), my net revenue per 0.25 hectare of land is BDT 450 ($5.80) and farmers' savings of total cultivation cost hit BDT 900 ($11.60)."

– Nishikanta Mandal with his wife (third from left), daughter (second from left), and other relatives

Marketed by machinery importer RFL, the seeder-fertilizer drill (SFD) simultaneously tills, plants, and fertilizes crops in line and with greater precision. It also boosts input use efficiencies and crop yields and allows farmers to plant using conservation agriculture practices that reduce production costs. The USAID-funded Cereal Systems Initiative for South Asia–Mechanization and Irrigation (CSISA-MI) project, part of president Obama's Feed the Future (FtF) initiative, is facilitating the introduction of SFDs into the Bangladeshi agricultural sector. Local service provider (LSP) Nishikanta purchased the SFD in October 2013, and is currently earning BDT 50,000 (US$644.27) per season offering the machine's service to fellow farmers. "My capital was recovered within the same season that I bought the machine. I was also able to run my household and pay for my children's academic expenses with the returns," he shared, adding that earlier fulfilling his children's expenses instantly was quite difficult for him.

For Nishikanta, the machine cost BDT 22,000 ($283.48) though the original price was BDT 58,000 ($747.36). "As part of the promotional voucher scheme, I paid the rest of the money by cultivating 8.09 hectares of land for free. Even after that, I could cultivate another 16.10 hectares of land during the same season." In these nine months, Nishikanta cultivated more than 42.49 hectares of land with the SFD. He used it to cultivate wheat, sesame, jute, and peas. It can also be used for maize and mustard cultivation. "Observing the healthy growth of plants, less cultivation costs, and better yield, farmers came forward to use the SFD." Currently, there are three LSPs, including Nishikanta, offering SFD services in his village. Five more farmers confirmed that they would buy it in the coming season.

Nishikanta previously used the power tiller, which allowed him to cultivate only 3.24 hectares of land in a season, and required him to engage at least three laborers at a total cost of BDT 54,000 ($695.82) per month. "At least five passes of tillage are necessary to prepare land using a power tiller. It costs BDT 1,250 ($16.11) for 0.25 hectare of land. Conversely, the SFD requires only one pass for tilling, seeding, and fertilizing simultaneously and costs BDT 600 ($7.73) only. Cultivation costs are reduced further for less labor engagement and efficient use of seed and fertilizer. With these returns, Nishikanta could invest in his livestock. "Earlier, we had only two cows and one goat. Now, I possess five cows and five goats," he shared. In addition, he has started saving BDT 400 ($5.15) per month for the betterment of his children's future.

3.2 Range of nutritious food consumed (Sub IR 2)

Maize and wheat

Maize-based human foods: great for family nutrition and increased income

Sakhina Begum of Agmundia Village under Kaliganj upazilla, Jhenaidah, has a business selling food items such as *beguni* (brinjal chips boiled in oil), *piyazu* (an onion-pulse flour mix fried in oil), *singara* (a wheat flour-based pastry with potato inside, cooked in oil), and potato chips. The income she was earning was not very high, however. She became a member of the Agmundia Women's Group under CSISA-BD, Jessore hub, and was later trained on the processing of maize for human consumption by CSISA-BD. She has started using grains and fresh ears of locally grown maize, as well as sweetcorn and popcorn, as the basis for maize-based food sold by her business. Soon, she was being invited to several events (Fig. 25):

- Women Entrepreneurs' Workshop in Khulna, organized by CSISA-BD (16-18 November 2013);
- Organic Foods and PITHA (local cakes) Fair, Farashpur Primary School Ground, Kaliganj, Jhenaidah (6 February 2014); and
- USAID-organized Women's Fair at Begum Rokeya University, Rangpur (7-9 April 2014).

Her household income has increased tremendously with the inclusion of new maize food items such as popcorn (of several different flavors), maize crunchy grain-nuts, soft grain roasts, roasted cobs, and fresh sweetcorn. Previously, her daily net profit was BDT 250−300, which more than doubled to BDT 600−700 per day with the addition of maize food items on offer. With this new income, she and her family have now purchased land, a young cow, and a goat while maintaining the daily living costs of seven family members.

Aquaculture

More than 60% of the people in Bangladesh do not receive enough vitamin A, iron, and zinc from their diet to meet nutritional requirements—with young children and pregnant and lactating women being particularly vulnerable. Inadequate intake of fruits, vegetables, fish, and other animal-source foods is a direct cause of micronutrient deficiency.

Fig. 25. Sakhina Begum at a food fair in Jhenaidah.

Interventions initiated by the CSISA-BD aquaculture team to contribute to alleviating these problems have included the production of cash-earning carp and tilapia with small nutrient-rich fish, such as mola (*Amblypharyngodon mola*), and the production of vegetables on pond banks. Standard CSISA-BD aquaculture training includes nutrition education, the value of eating mola fish, and the consumption requirements of pregnant and lactating women. For this training, women[4] are targeted as they have the primary role for ensuring intrahousehold food distribution and have responsibility within households for the use of homestead land where foods with a high nutritional value can be produced. In this reporting period, 1,027 women farmers were given training on carp/mola fish

[4] This year, CSISA and WorldFish are also experimenting (in Faridpur) with involving men and other family members in homestead and nutrition-related training sessions as they often influence women's consumption.

and vegetable production and on nutrition awareness. In addition, 1,169 women trained in 2013 were given refresher training this year.

Reviewed the horticultural production model

The CSISA-BD aquaculture program has developed vegetable production recommendations for the three main fish-producing environments they support (homestead ponds, commercial ponds, ghers); Table 21 displays the type of vegetables produced by CSISA-BD farmers in each of these three environments.

Table 21. Household-based production model on homestead, pond dikes, or their banks

Resources	Dry season	Early monsoon	Late monsoon
Homestead pond banks			
Pond dikes and their edges	*Tomato, bottle gourd, country bean, orange sweet potato, sweet gourd/pumpkin, knolkhol*	*Bitter gourd, ash gourd, okra, cucumber, sweet gourd/pumpkin, kangkong, papaya*	*Cucumber, bitter gourd, bottle gourd, ash gourd, kangkong*
Fallow cultivable/open land of homestead	*Carrot, orange sweet potato, tomato, cauliflower, cabbage, country bean, bottle gourd, spinach, red amaranth, sweet gourd, chili, knolkhol*	*Kangkong, chili, red amaranth, Indian spinach, okra, sweet gourd, bitter gourd, ash gourd, bottle gourd, papaya*	*Indian spinach, bitter gourd, kangkong, red amaranth, ash gourd, bottle gourd*
Roofs of houses	*Country bean, sweet gourd, bottle gourd*	*Ash gourd, sweet gourd, Indian spinach*	*Ash gourd, sweet gourd*
Nonfruit trees	*Country bean, bottle gourd*	*Ash gourd, sponge gourd, ridge gourd, sweet gourd*	*Ash gourd, sponge gourd, ridge gourd*
Pond dikes/banks; gher dikes/banks			
Pond dikes/edges	*Tomato, country bean, knolkhol, bottle gourd, OSP*	*Bitter gourd, cucumber, bottle gourd, ash gourd, okra, sweet gourd, yardlong bean, ridge gourd*	
Gher Dikes/edges	*Tomato, Country Bean, Knolkhol, OSP*	*Bitter gourd, cucumber, bottle gourd, ash gourd, okra, sweet gourd, yardlong bean, ridge gourd*	

Promotion of vitamin-A-rich orange sweet potato (OSP) as a means of family nutrition and additional income

To address the nutritional deficiency in rural farming households, CSISA-BD has taken initiatives to promote orange sweet potato (OSP) cultivation at a small scale in the homestead area by involving women. As a part of this promotion, CSISA-BD not only distributes vines and other projects but also builds up women as vine-selling entrepreneurs. In 2013, 119 women beneficiaries grew OSP vines and developed themselves as entrepreneurs who supplied and sold all required OSP vines to the Year-3 beneficiaries and also to other projects and organizations.

3.3 Women's participation in food security activities (Sub IR 3)

CSISA-BD aims to reduce the technology adoption gap between men and women by ensuring that both men and women farmers are involved in the technology development and dissemination process.

Trial of new extension approaches for targeting women

Evidence from a study on the impact of two women-targeted aquaculture technologies (i.e., cage aquaculture and pond polyculture) tested in four villages from the Barisal and Khulna hubs has shown that just providing technical solutions for women may not be enough to enable

sustained use and equitable benefits from technologies. This discrepancy between expected and actual outcomes arises because women and men exist in a multidimensional system of gender relationships that influence women's ability to gain and apply knowledge about technologies. This reduces their ability to achieve the anticipated production and consumption outcomes and to obtain an equitable share of the benefits from these outcomes. Results from the study have informed a trial of a new aquaculture technology dissemination approach in two villages of CSISA-BD's Faridpur hub. The technology package has been re-designed to combine the technical aspects of aquaculture training with gender consciousness-raising exercises derived from HKI's *Nurturing Connections* manual. Families are involved from the beginning of the intervention and the training is modularized to interact with the different stages of the production cycle and address any social and gender issues that may arise as a result of applying new knowledge. Changes in production and in knowledge, attitudes, and practices (both technical and social) are being monitored among the participating women and their spouses through survey research methods and process documentation. This research will most likely have a profound impact on the way in which CSISA-BD and other development programs transfer technology to women.

CSISA-BD participation in USAID-organized Gender and Development Fair at Begum Rokeya University, Rangpur, in April 2014

In a stall called "Enabling women and men farmer-led innovation," CSISA-BD and CSISA-MI organized a display where the project's various women-targeted technologies were showcased and various publications distributed. Some farmers were also brought in to sell their produce and show their use of technology, Infoladies talked about their extension services, clay models were built showing the homestead system, nutritious food options were on display, and videos interviewing different successful women farmers were shown. In a plenary session, the CSISA-BD aquaculture team presented a paper called "Aquaculture technologies do enable women's economic advancement but have the potential for more sustained, equitable, and even gender-transformative outcomes: A look into the CSISA-BD and AIN women-targeted aquaculture technologies."

CSISA-BD celebration of International Women's Day on 9 March 2014

On 9 March, WorldFish and Helen Keller International organized a half-day workshop at Lake Shore Hotel called "Inspiring Change: Institutionalizing Gender in Nutrition and Agricultural Interventions," in which CSISA-BD presented its ideas for trying out new technology delivery approaches for women based on the study results.

www.worldfishcenter.org/news-events/institutionalise-gender-nutrition-agriculture-interventions#.VFcGFPmUdqU

Women Working in Maize and Wheat New Technologies in Bangladesh, CIMMYT, CSISA-BD

Rangpur


Women in Debicharan, Gokunda, and Zahangirabad villages are really happy to receive important knowledge on best practices for maize and wheat production, as well as for obtaining good yields that provides increased income for their families.

Mymensingh


Women from Jelkhanar char grow fast-growing economic crops such as red amaranth or coriander as intercropping alternatives within a maize crop, which provides food for their family and much additional income while waiting for the harvesting of maize.

Jessore


In Jessore, women are happy with their high-value garden pea and French beans, which they grow intercropped with sweet corn and hybrid maize. This activity has added an income of 4,000 to 7,000 BDT per woman's small area of 4 to 7 decimals. The sweet corn provides a return of 2,000 to 4,000 BDT per decimal.

Faridpur


Women in Rajbari Sadar in Faridpur hub are gladly drying wheat seed in their home yards, which is generating income for their families.

Khulna

Women are enthusiastic for growing maize for selling as grain, beans for home consumption, and sunflower to produce a high-priced oil. These women feel empowered by what they have learned, and are proud to explain their experiences to researchers and other visitors to their communities.

Barisal


Women in Barisal are happy cultivating improved varieties of maize. They hope that this activity will generate increasing income for their families, and Dipu in particular is hoping to buy a maize sheller soon since she has seen the benefits of this machine owned by her village association.

4 PROJECT MANAGEMENT

4.1 Administration and coordination

4.1.1 Project personnel

Figure 26 illustrates that the project employs 143 staff members (91% males, 9% females), of which 103 (72%) are posted in the hubs and 40 (28%) are in Dhaka. IRRI employs 51% of the total staff, followed by CIMMYT (29%) and WorldFish (20%).

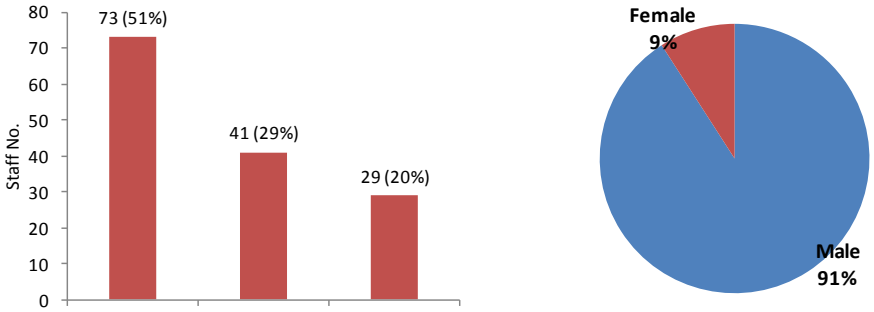


Fig. 26. CSISA-BD staff employment, by CGIAR center and gender.

The project employed five new ADOs for Khulna, Jessore, and Faridpur, two M&E officers for Faridpur and Mymensingh, and two hub managers for Khulna and Barisal. CIMMYT has promoted one staff member to take responsibility for the hub manager position in Rangpur. One hub accounts officer was moved to the Dhaka office and another one transferred from Rangpur to Barisal hub to improve the hub's financial operations. One M&E database consultant was engaged by the project management to develop a project database.

4.1.2 Procuring equipment, vehicles, and logistics

A number of printers and scientific equipment were procured to support project research activities. The project has procured and installed air conditioners in the Rangpur and Barisal hub to improve the workplace environment.

4.1.3 Management and coordination in hubs

The Project Management Unit (PMU) team meets every fortnight and the hub management team meets every month. In the reporting period, a total of 20 meetings were held at the PMU level and 60 meetings were held in all hubs.

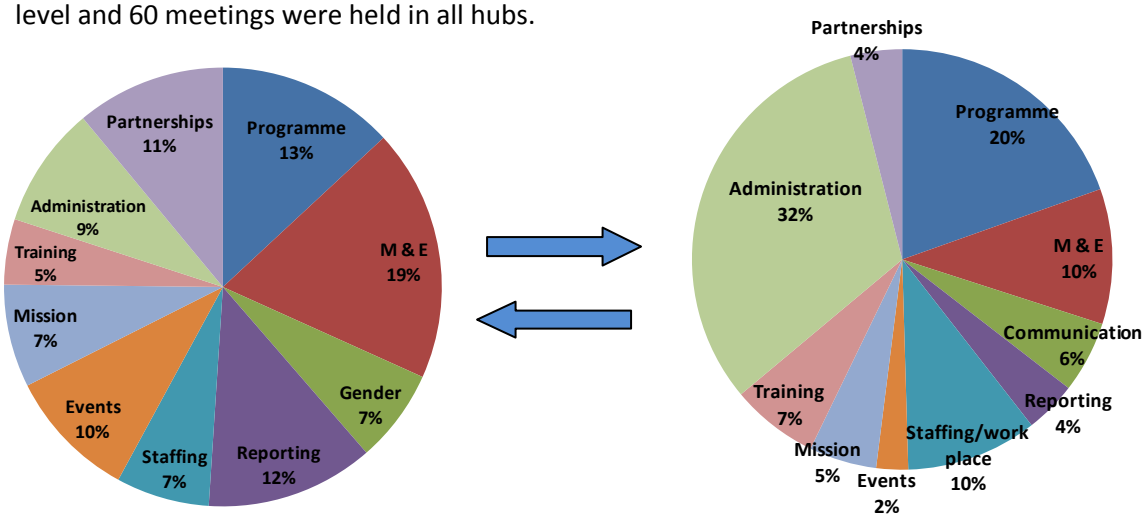


Fig. 27. Issues discussed in the PMU and hub coordination meetings.

Figure 27 shows that, at the PMU level, M&E (19%) was the top-prioritized issue in discussions, followed by program issues (13%), reporting (12%), partnerships (11%), and event management (10%). At the hub level, administrative arrangements (32%) was the highest-prioritized issue in discussions, followed by program issues (20%), M&E (10%), and staffing/work place (10%).

The CSISA-BD project is coordinating with the CSISA-MI project in four hubs, Barisal, Khulna, Faridpur, and Jessore, through sharing of common resources. In these hubs, the hub accounts officers are providing technical support to the CSISA-MI project staff for financial operations and day-to-day accounting work. The office space in Khulna hub has been extended and the Barisal hub office was relocated so that office facilities could be shared with the CSISA-MI project. The project has also relocated the satellite office in Patuakhali to operate the satellite office in a more secure place.

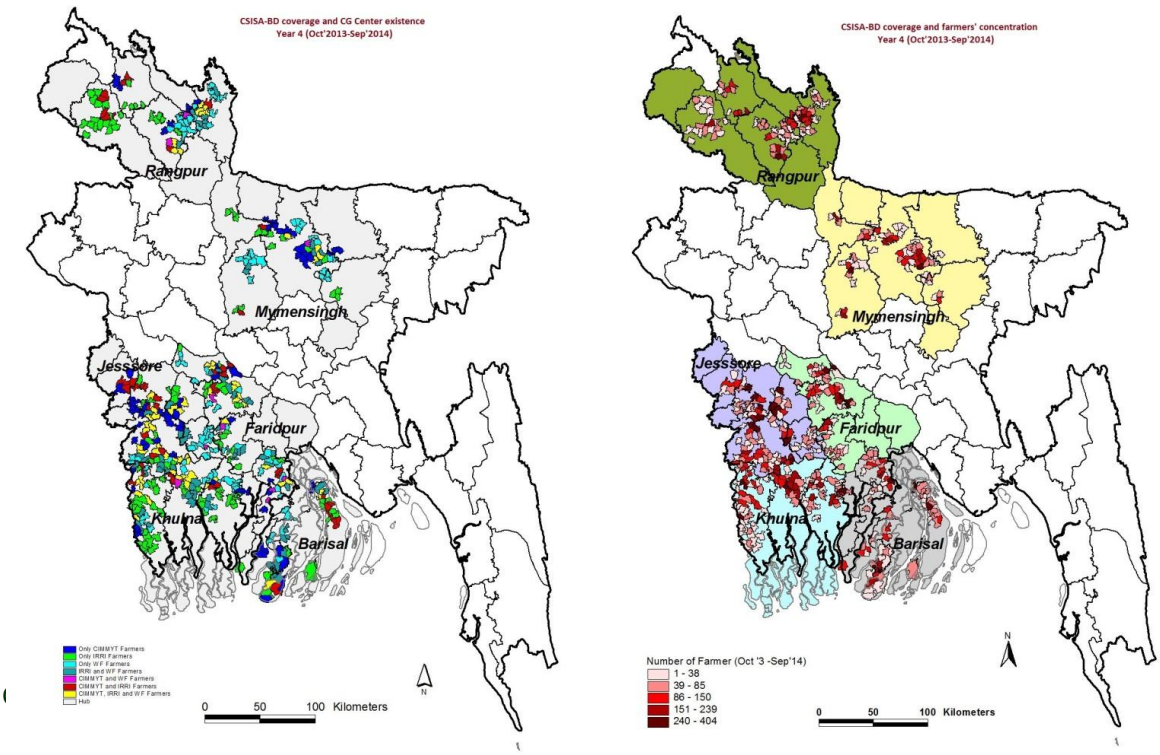
4.2 Project monitoring and evaluation

In December 2013, the project finalized revisions of the CSISA-BD Performance Monitoring and Evaluation Plan (PMEP) and submitted it to USAID for approval. The M&E plan includes the project's development hypothesis and an updated and reworked Results Framework (RF). During the first three years of CSISA-BD, the project reported on its progress against nine FtF indicators; however, from this reporting year, CSISA-BD has agreed with USAID Bangladesh Mission to report on six FtF Indicators (three output indicators and three outcome indicators). Project personnel, in consultation with USAID, reviewed the project objectives and matched them with the corresponding indicators. Two custom indicators were created to measure results for cases in which there were no corresponding FtF indicators.

To implement the project M&E plan, CSISA-BD developed an operational guideline (CSISA-BD M&E and MIS Guideline) for the project staff. For documentation purposes, the project has implemented clear instructions for organizing CSISA-BD documents at the hub level, which makes the data easily accessible to all CSISA-BD staff as well as outside auditors. Following recommendations made by the USAID DQA team, an annual internal DQA process has been institutionalized within the project to ensure that data quality is maintained.

Internal data quality assessment (DQA). An internal DQA was conducted in all six hubs by the central M&E team from 23 February to 25 March 2014; details are provided in the project's Year 4 semi-annual report.

The CSISA-BD Database project designed a unique database for the storage of project



information in a systematic manner. Through this database, the project staff are provided with a unique ID for each project-participating household and household member. This ID helps them to identify the event and CG center that provided a farmer with support. The GIS-generated maps shown here show where the project works and the location of trials and demonstrations.

Baseline survey; adoption and impact survey of Year 2 farmers (AIS-Y2F)

A draft report summarizing some of the data and information collected from the 2012 CSISA-BD baseline survey was produced during February and March 2014. Further work on the report during the remainder of 2014 is anticipated such that a more comprehensive final report can be issued. Selected results from the AIS-Y2F were discussed under Section 3.1.1; other results were presented previously in the project's Year 4 semi-annual report.

Indirect farmer survey

The indirect farmer survey (IFS) was conducted during 2-24 July 2014, following nine days of training/questionnaire pretesting. It was a relatively small-sample survey of farmers that indirectly received benefits from the CSISA-BD project, ostensibly through knowledge- and skills-transfer from direct project beneficiaries (i.e., so-called "CSISA farmers"). The objective of the survey was therefore to validate that such transfers actually took place from known CSISA farmers.

The sample frame consisted of the names of so-called "indirect farmers" that were provided to the project by Year 2 CSISA-BD farmers who were interviewed during the AIS-Y2F (conducted from November 2013 to January 2014). A sample list totaling 597 indirect farmers was generated, although realistically only 425−450 indirect farmers were expected to be sampled given constraints such as farmer availability, etc. Thus, the actual number of sample households interviewed for the survey was **N** = 375. Although this number (**N**) is somewhat lower than the a priori expectation, it is acceptable given the purpose of the survey.

The IFS was also the first time CSISA-BD used a paperless data collection system. This involved the enumerators completing questionnaires on a laptop (see photo opposite). The questionnaire was developed and implemented using the licensed software ***Surveybe***. This will greatly reduce data compilation time and improve data quality.

Data analysis from this survey is ongoing; therefore, limited results are presented below.

Table 22 summarizes the preliminary results of the IFS in terms of technologies/management practices being applied by indirect farmers and the main sources of their learning. The table is subdivided by the main crop categories that are the focus of CSISA-BD (e.g., upland crops [maize and wheat], rice [aman, boro, and aus], and aquaculture crops [fish, prawns, and shrimp]); each crop category lists the five most identified technologies/management practices applied by indirect farmers for the crop category in question.

Table 22. Selected technologies/management practices applied by indirect farmers sampled (N = 375).

Technology/management practice by main crop category	Sample info			Area applied (decimals)		Source of learning		
	m	n	n/m	Average	Median	CSISA farmers	Other farmers	DAE/ DoF *
Rice (Nc† = 273)								
Other modern HYVs (BR-10,23,28,29,48,50)	167	63	38%	104.3	76.7	40%	14%	30%
Line transplanting	180	76	42%	129.6	100	34%	11%	37%
Two to three seedlings sown per hill	131	59	45%	132.7	100	40%	10%	25%
Recommended seedling spacing	111	55	50%	126.3	100	51%	9%	20%
Recommended urea application rate	132	75	57%	129.6	110	48%	15%	23%
Maize and wheat (Nc = 148)								
Recommended wheat sowing dates	80	63	79%	59.4	42	51%	18%	5%
Recommended row/seed spacing for maize	67	56	84%	39.4	32	71%	13%	7%
Recommended fertilizer doses	119	101	85%	53.2	33	55%	12%	8%
Recommended timing of fertilizer	113	99	88%	59.2	36	58%	14%	11%
Recommended irrigation timing/rate	105	87	83%	48.8	33	55%	12%	7%
Fish, prawns, and shrimp (Nc = 126)								
Drying pond or gher	78	51	65%	74.8	33	45%	16%	12%
Prepare pond or gher with lime	104	65	62%	97.9	30	56%	13%	9%
Count fingerlings during stocking	80	55	69%	47.9	20	58%	11%	9%
Sampling regularly	90	60	67%	58.3	25	57%	13%	10%
Fertilizer to increase water productivity	75	53	71%	77.6	30	68%	8%	13%

* Department of Fisheries (DoF) applies only to aquaculture crops (the last five rows).

† "Nc" is the number of households (out of N = 375) that reported cultivating the crops of a given crop category.

The data shown in the first column ("m") of Table 24 indicate how many respondents reported that their household applied, within the previous 12 months, the technology/management practice in question. The second data column ("n") specifies the number of farmers that first applied the given technology or management practice during or after 2011 (the first year of the project). For example, 180 of the 273 rice farmers of the survey said they applied line transplanting during the 12 months preceding the interview. Of the 180, 76 farmers (42%) first applied line transplanting in 2011 or later, on an average of 129.6 decimals of land. Of these 76 farmers, 34% ascribe their learning of this technique to a CSISA farmer, whereas 11% and 37% indicated they learned this practice from other farmers and the DAE, respectively.

Adoption and impact surveys: Year 3 farmers and Year 2 farmers revisited

Similar in scope and construction to the adoption and impact survey of Year 2 farmers (AIS-Y2F) conducted last year, CSISA-BD initiated a sequel in September 2014 (Q4, Year 4) that targets 1,220 households that were engaged by the project during Year 3 (2012-13). This survey (AIS-Y3F) is stratified such that 340 households were randomly selected for each CGIAR center from the respective lists of Year 3 project beneficiaries, with another 200 so-called "combined" farmers randomly selected as well. Note that a combined farmer is one who has received training from any two, or all three, of the CSISA-BD core partners (CIMMYT, IRRI, WorldFish).

The key objectives of this survey are to

- Assess the effectiveness of training activities, and demonstrations and/or research trials, on project-promoted technologies and management;
- Estimate/validate the rates of adoption of, and extent of area covered by, key technologies and management practices promoted by CSISA-BD; and
- Estimate gains in the yield and gross margin values for maize, rice, wheat, fish, and shrimp from applied improved technologies and/or management practices;

As part of field effort to complete the AIS-Y3F, the survey team will also be targeting 600 of the Year 2 farmers (sampled during the AIS-Y2F) for re-interviews. The purpose of this "revisit survey" is to estimate the continuity of technology adoption and economic impact over the course of multiple seasons/years.

4.3 Communications

CSISA-BD information can be accessed at http://csisa.org/where-we-work/csisa-bangladesh/ and the project's Facebook page (updated weekly) is located at www.facebook.com/csisabd. CSISA-BD organized, presented, and participated in various workshops, seminars, fairs, linkage events, and training events that received news coverage in various local newspapers, on television, etc., in both English and Bengali. Selected events are shown in Tables 23 and 24.

Table 23. CSISA-BD-organized regional and national stakeholder workshops

Title of event	Who, where, and when	Comment/link
Hub-level stakeholder workshops	Annual meeting with main GOB, NGO, and private sector partners; held in every hub.	Allows the project to share results from trials and demonstrations with stakeholders, and to hear from them regarding the main constraints they believe are hindering crop and aquaculture production.
Workshop: "MTR (Mid-Term Review) results for CSISA-BD team"	Hub-level stakeholder meetings (Jessore, Khulna, Barisal, and Mymensingh); national stakeholder meeting, BRAC Center Inn, Dhaka, 30 Mar 2014	Allowed the MTR team to understand the level of involvement CSISA-BD has in local agricultural development initiatives. Also allowed project staff to summarize progress of CSISA-BD with stakeholders.

Table 24. CSISA-BD-organized workshops, seminars, fairs, and linkage events

Title of event	Who, where, and when	Comment/link
Intl. Women's Day Workshop: "Inspiring Change: Institutionalizing Gender in Nutrition and Agriculture Interventions"	WorldFish, CSISA-BD, AIN, and HKI; Lake Shore Hotel, Dhaka, 9 March 2014	www.bssnews.net/newsDetails.php?cat=0&id=394891&date=2014-03-09 www.slideshare.net/worldfishcenter/gender-transformative-approaches-in-nutrition-and-aquatic-agricultural-interventions-by-afrina-choudhurypaula-kantor-and-miranda-morganworldfish
Stakeholder workshop: "Enhancing the Gender-Equitable Potential of Aquaculture Technologies"	WorldFish, funded by CCAFS; Hotel Sarina, Banani, Dhaka, 20 Feb. 2014	Study results on CSISA-BD women-targeted technologies shared
Workshop: "Mentoring and Connecting Women Entrepreneurs in Business"	IRRI organized with CSISA-BD and UN Women; CSS AVA Center, Khulna, 15-16 Nov. 2013	http://irri-news.blogspot.com/2013/11/bangladesh-women-entrepreneurs-seek-to.html www.thefinancialexpress-bd.com/2013/11/17/4225/print
Workshop: "Women in the Brackish-Water Shrimp Zone of Southwest Bangladesh: Challenges and Opportunities"	WorldFish organized with CSISA-BD, AIN, and Save the Children and funded by IFAD; Mozaffar Garden Resort, Satkhira, 8-9 Nov. 2013	
Workshop: "CSISA Approach, Experiences, and Collaboration with Stakeholders in Faridpur Region"	CSISA-BD; 29 Sept. 2013; BRAC Learning Centre, Dumrakandi, Faridpur.	https://www.facebook.com/media/set/?set=a.556769764403686.1073741843.339848336095831&type=1
Workshop: "Commercial Aquaculture and Exchange of Opinions"	CSISA-BD, WorldFish, Jessore Hub, 24 Sept. 2013	Telecast on Channel I and GTV on 25 September at 5:15 p.m. https://www.facebook.com/CSISABD/posts/541684142578915
Conference: "12th Bangladesh Agronomy Society"	BARC, 20 Sept. 2013	Dr. Parimal Chandra Sarker, associate scientist, CSISA-BD, IRRI, won second-best presenter award https://www.facebook.com/photo.php?fbid=733114086705456&set=o.339848336095831&type=1&relevant_count=34
Workshop: Stakeholder consultation workshop in Rangpur	CSISA-BD, WorldFish; Rajaraht Union Parishad auditorium, Kurigram, Rangpur, 12 Sept. 2013	http://thebangladeshtoday.com/business/2013/09/improved-management-for-enhancing-fish-production-stressed/
Linkage event: Enhanced cultivation of mono-sex tilapia fish by adopting improved farming management technology	Mizanur Rahman's farm, Tulshipur, Mithapukur, Rangpur, 3 Sept. 2013	www1.bssnews.net/newsDetails.php?cat=2&id=355770&date=2013-09-04
CSISA-BD planning meeting	CSISA-BD, BRAC Center Inn, Dhaka, 4-5 Sept. 2013	
Workshop: "Formulation of Strategies for Quality Fish Seed Production"	WorldFish, CSISA-BD, Rangpur, 29 Aug. 2013	www1.bssnews.net/newsDetails.php?cat=0&id=354425$date=2013-08-29&dateCurrent=2013-09-04

Selected materials prepared by CSISA-BD in Year 4 appear in Table 25.

Table 25. Selected materials prepared by CSISA-BD in Year 4.

Type	Description
Book	Made in Bangladesh: Scale-appropriate machinery for agricultural resource conservation http://blog.cimmyt.org/machinery-book-published-in-bangladesh/
Report	CSISA-BD Year 3 Annual Report
Newsletter	CSISA-BD October 2013 4th Quarterly Newsletter http://csisa.org/wp-content/uploads/sites/2/2013/08/CSISA-BD-Newsletter-Issue-4.pdf
Flip-chart/ banner	Monthly fish price trends
Factsheet	CSISA-BD 2013 Fish week winners' factsheet

4.4 Partnerships

CSISA-BD works with a wide range of partners from GOB agencies, NGOs, and the private sector, in addition to farmers. Strengthening of project partnerships involves mobilization (through LoA/MoU) and capacity building of the selected partners to effectively engage them in their respective project roles locally, regionally (hub), and nationally.

In the reporting period, CSISA-BD works with other USAID partners (e.g., IFDC, IFPRI, and iDE) and other FtF projects (AIP, AIN, and an agricultural extension project) as well as the MYAP partners CARE and Save the Children. It is also working with partners of ACIAR-funded projects (Rice-Maize project, Climate Change Adaptation project, and Rice-Pulse project), the IFAD-funded Climate Change Adaptation project, and BMGF-funded STRASA project.

4.4.1 Partnerships with government organizations

IRRI, CIMMYT, and WorldFish have long-standing partnerships in Bangladesh with government agencies such as BARC, BRRI, BARI, BFRI, DAE, and DOF that have been continued through CSISA-BD. In the reporting period, a total of four LoAs were awarded by the project for three partners, BINA, BARI, and BRRI. Out of these four, IRRI and CIMMYT both awarded two contracts for a total of US$54,374.

4.4.2 Partnerships with NGOs and private organizations

The project implements field activities through partner NGOs (PNGO) that provide field staff with bicycles for transportation. They help the project organize farmer meetings, training events, and field days. They participate in training events by giving some of the training and in implementing and collecting data from trials and demonstrations. Project staff support the PNGO staff by providing them with ToT, supporting them when training farmers, and supervising the implementation of trials and demonstrations.

In the reporting period, a total of 41 LoAs, MoUs, and service contracts were awarded by the three CG centers for 22 partners (including NGOs and private companies). In the reporting period, a total of $1,096,866 was disbursed to the partners, out of which $916,728 (84%) was disbursed to the NGO partners, followed by the private sector ($125,764; 11%) and government organizations ($54,374; 5%) (Fig. 28). Among the three CG centers, IRRI disbursed $728,387 (67%), followed by WorldFish ($234,362; 21%) and CIMMYT ($134,117; 12%).

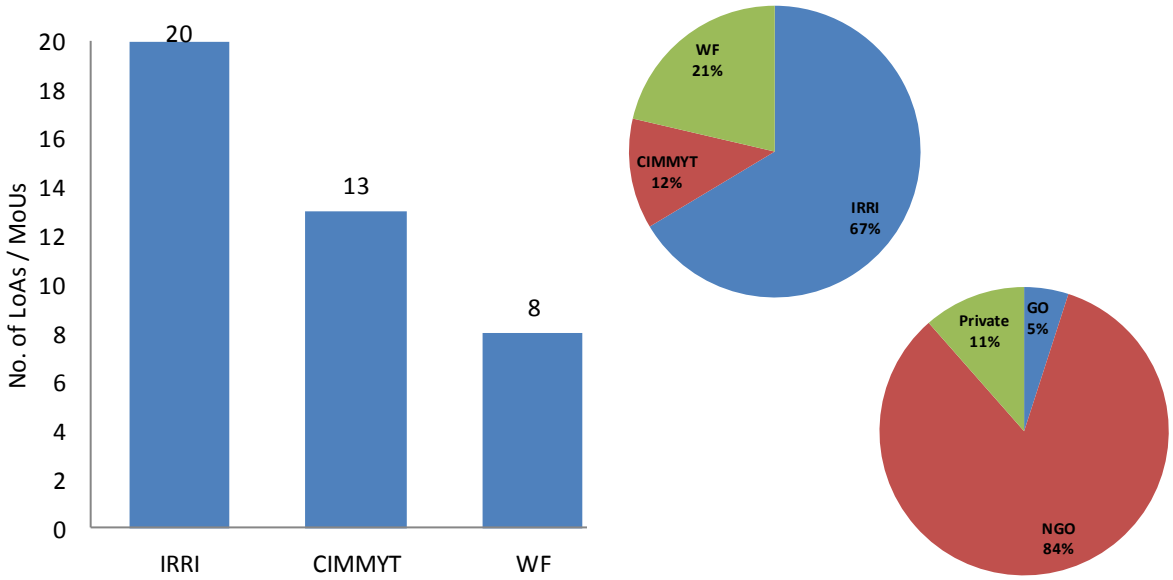


Fig. 28. Summary of partnerships with GOs, NGOs, and private organizations

Common partners in hubs. During the reporting period, JCF, TMSS, BDS, and SDC are common partners in Jessore, Khulna, Barisal, and Faridpur, as shown in Table 26. GJUS, ST, APEX, and Solidarity are common partners of IRRI and CIMMYT in Barisal, Mymensingh, and Rangpur hubs, respectively.

Table 26. Common NGO partners among the CG centers, by hub.

Hub	IRRI	CIMMYT	WF
Barisal	BDS	BDS	BDS
	GJUS	GJUS	--
	ST	ST	--
Faridpur	SDC	SDC	SDC
Jessore	JCF	JCF	JCF
	BS	--	BS
Khulna	TMSS	TMSS	TMSS
Mymensingh	APEX	APEX	--
Rangpur	Solidarity	Solidarity	--

JCF = Jagoroni Chakra Foundation, TMSS = Thenga Mara Mohila Sobuj Sanga,

BDS = Bangladesh Development Society; ST = Speed Trust,

SDC = Society Development Committee,

GJUS = Grameen Jano Unnayan Sangstha.

Annex 1. List of LoAs, MoUs, and Service Contracts

Table 27. List of LoAs, MoUs, and service contracts, IRRI.

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
1.	Letter of Agreement (LoA) between IRRI and Speed Trust for implementing activities under CSISA-BD project for Barisal hub	Head of mission, Speed Trust	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	22,524
2.	Letter of Agreement (LoA) between IRRI and BDS for implementing activities under CSISA-BD project for Barisal hub	Executive director, Bangladesh Development Society (BDS)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	29,674
3.	Letter of Agreement (LoA) between IRRI and GJUS for implementing activities under CSISA-BD for Barisal hub	Executive director, Grameen Jano Unnayan Sangstha (GJUS)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	21,260
4.	Letter of Agreement (LoA) between IRRI and ADO for implementing activities under CSISA-BD project for Khulna hub	Executive director, Area Development Organization (ADO)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	26,007
5.	Letter of Agreement (LoA) between IRRI and Ashroy Foundation for implementing activities under CSISA-BD project for Khulna Hub	Executive director, Ashroy Foundation	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	14,629
6.	Letter of Agreement (LoA) between IRRI and SEDOP for implementing activities under CSISA-BD project for	Executive director, Socio Economic Development	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	26,007

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
	Khulna hub	Organization for the Poor (SEDOP)				
7.	Letter of Agreement (LoA) between IRRI and Uttaran for implementing activities under CSISA-BD project for Khulna hub	Director, Uttaran	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	26,007
8.	Letter of Agreement (LoA) between IRRI and TMSS for implementing activities under CSISA-BD project for Khulna hub	Executive director, Tengamara Mohila Sabuj Sangha (TMSS)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	46,443
9.	Letter of Agreement (LoA) between IRRI and Jagoroni Chakra Foundation (JCF) for implementing activities under CSISA-BD project for Jessore hub	Executive drector, Jagoroni Chakra Foundation (JCF)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	69,764
10.	Letter of Agreement (LoA) between IRRI and People's Resources in Development Enterprise (PRIDE) for implementing activities under CSISA-BD project for Jessore hub	Executive director, PRIDE	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	48,485
11.	Letter of Agreement (LoA) between IRRI and RIB for implementing activities under CSISA-BD project for Rangpur hub	Chairman, Research Initiative Bangladesh (RIB)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/12/2013	31/9/2014	27,566
12.	Letter of Agreement (LoA) between IRRI and Solidarity for implementing activities under CSISA-BD project for Rangpur hub	Executive director, Solidarity	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	29,520

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
13.	Letter of Agreement (LoA) between IRRI and the Society for UDDOG for implementing activities under CSISA-BD project for Rangpur hub	Executive director, Society for UDDOG	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/11/2013	31/9/2014	32,284
14.	Letter of Agreement (LoA) between IRRI and Society Development Committee (SDC) for implementing activities under CSISA-BD project for Faridpur hub	Executive director, Society Development Committee (SDC)	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/10/2013	31/9/2014	53,404
15.	Letter of Agreement (LoA) between IRRI and APEX for implementing activities under CSISA-BD project for Mymensingh	Executive director, APEX	Collaborate on CSISA-BD activities, including training, farmer field days, demonstrations, etc.	1/10/2013	31/9/2014	66,186
16.	Letter of Agreement (LoA) between IRRI and People's Resources in Development Enterprise (PRIDE) for implementing the InfoLady agricultural entrepreneur project under CSISA-BD project for Jessore hub	Executive director, PRIDE	Integration of InfoLady model into the agricultural sector for providing farmers with Internet-based agricultural information that could be replicated on a larger scale	1/1/2014	28/2/2015	27,020
17.	Letter of Agreement (LoA) between IRRI and Bangladesh Institute of Nuclear Agriculture (BINA) under CSISA-BD project in coastal areas	Director general, BINA, BAU Campus, Mymensingh	Rapid mass screening for salt tolerance of local coastal rice varieties, purification, characterization, and promotion	1/6/2013	31/5/2014	12,000
18.	Letter of Agreement (LoA) between IRRI and Bangladesh Rice Research Institute (BRRI) under CSISA-BD project	Director general, BRRI, Gazipur	Implementation of CSISA-BD project activities	1/1/2013	31/6/2014	33,760
19.	Agreement between Participatory Management Initiative (PMID) in	Md. Rafiqul Islam, managing partner,	Annual survey for technology adoption of the project-supported	1/11/2013	15/5/2014	17,411

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
	association with Bangladesh Centre for Advanced Studies (BCAS) with CSISA-BD project	PMID	farmers			
20	Agreement between Dexis, USA, and CSISA-BD project	Mihir Desai, chief executive officer, Dexis Consulting Group, USA	Conduct mid-term evaluation of the project	15/3/2014	15/5/2014	98,436
	Total (individual: 18; common: 2)	**20**				**728,387**

Table 28. List of LoAs, MoUs, and service contracts, CIMMYT.

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
1.	Subgrant letter between CIMMYT-Bangladesh and APEX	Dr. Bilkis Mortuja Parven, executive director, APEX	To establish a mutually beneficial relationship between CIMMYT-BD and APEX to contribute to efforts in developing and sustaining local farming systems in Mymensingh through training, establishment of linkages, formation of farmers' groups, etc.	1/10/2013	30/9/2014	14,317
2.	Subgrant letter between CIMMYT-Bangladesh and Solidarity	Mr. S.M. Harun Ar Rashid Lal, executive director, Solidarity	To establish a cooperative and mutually beneficial relationship between CIMMYT-BD and Solidarity in order to implement initiatives to improve maize, wheat, and vegetable production, as well as to establish local maize marketing linkages in Rangpur.	1/10/2013	31/7/2014	9,313
3.	Subgrant letter between CIMMYT-Bangladesh and Jagorani Chakra Foundation (JCF)	Mr. Md. Wahiduzzaman, director microfinance, JCF	To establish a collaborative partnership between CIMMYT-BD and JCF for conducting field activities (group organization, training events) in Jessore.	1/10/2013	30/9/2014	28,171
4.	Subgrant letter between CIMMYT-Bangladesh and Bangladesh Development Society (BDS)	Mr. S.H. Kabir, executive director, (BDS)	To establish a collaborative partnership between CIMMYT-BD and BDS for conducting field activities (group organization, training events) in Barisal.	1/10/2013	30/9/2014	15,982

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
5.	Subgrant letter between CIMMYT-Bangladesh and Grameen Jano Unnayan Sangstha (GJUS)	Mr. Zakir Hossain Mohin, executive director, GJUS	To establish a collaborative partnership between CIMMYT-BD and GJUS for conducting field activities (group organization, training events) in Barisal.	1/10/2013	30/9/2014	13,445
6.	Subgrant letter between CIMMYT-Bangladesh and the Society for People's Education, Empowerment, and Development (Speed Trust)	Mr. A.H.M. Shamsul Islam, mission head, Speed Trust	To establish a collaborative partnership between CIMMYT-BD and Speed Trust to conduct field activities (group organization, training events) in Barisal.	1/10/2013	30/9/2014	9,359
7.	Subgrant letter between CIMMYT-Bangladesh and Social Advancement Community Organization (SACO)	Mr. Kazi Soyeb Fokrul, executive director, SACO	To establish a cooperative and mutually beneficial relationship between CIMMYT-BD and SACO that contributes to various field efforts (e.g., training, forming groups, etc.) on maize production and marketing in Barisal.	1/10/2013	30/9/2014	6,667
8.	Subgrant letter between CIMMYT-Bangladesh and Dak Diye Jai (DDJ)	Mr. Md. Shahjahan Gazi, executive director, DDJ	To establish a cooperative and mutually beneficial relationship between CIMMYT-BD and DDJ that contributes to various field efforts on maize production and marketing in Barisal.	1/10/2013	30/9/2014	6,667

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
9.	Subgrant letter between CIMMYT-Bangladesh and Society Development Committee (SDC)	Mr. Kazi Ashraful Hassan, executive director, SDC	To develop a collaborative partnership between CIMMYT-BD and SDC that contributes to various field efforts on maize and wheat production (e.g., training, group formation) as well as marketing in Faridpur.	1/10/2013	31/7/2014	9,806
10.	Subgrant letter between CIMMYT-Bangladesh and TMSS	Dr. Hosne-Ara Begum, executive director, TMSS	To establish a collaborative partnership between CIMMYT-BD and TMSS for conducting field activities (group organization, training events) in Khulna.	1/10/2013	30/9/2014	11,776
11.	Subgrant letter between CIMMYT-Bangladesh and Bangladesh Agricultural Research Institute (BARI)	Dr. Rafiqul Islam Mondal, director general, BARI	To establish a collaborative partnership between CIMMYT-BD and BARI to conduct trial experiments to intensify current cropping systems under environments with good soil quality and water availability in RARS, Jamalpur.	1/10/2013	30/9/2014	6,153
12.	Subgrant letter between CIMMYT-Bangladesh and Bangladesh Agricultural Research Institute (BARI)	Dr. Rafiqul Islam Mondal, director general, BARI	To establish a collaborative partnership between CIMMYT-BD and BARI to conduct trial experiments to improve productivity and soil fertility in wheat-based cropping systems in RWRC, BARI-Rajshahi.	1/10/2013	31/10/2014	2,461

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
13.	Letter of Agreement between CIMMYT-Bangladesh and Christian Commission for Development in Bangladesh (CCDB)	Mr. Joyanta Adhikari, executive director, CCDB	To establish a collaborative partnership between CIMMYT-BD and CCDB on agricultural development initiatives in selected indigenous communities in Rangpur.	1/10/2013	30/9/2014	--
	Total	**13**				**134,117**

Table 29. List of LoAs, MoUs, and service contracts, WorldFish.

Sl. no.	Title of LoA/MoU/service contract	Authorized person and organization	Objectives	Start date	End date	Amount (US$)
1.	MoA between WF and BRAC under CSISA-BD for Mymensingh, Faridpur, Barisal, Jessore, and Khulna hubs	Executive director, BRAC	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	118,167
2.	MoA between WF and Jagorani Chakra Foundation under CSISA-BD for Jessore hub	Executive director, JCF	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	27,323
3.	MoA between WF and Banchte Shekha under CSISA-BD for Jessore hub	Executive director, BS	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	7,704

4.	MoA between WF and Bangladesh Development Society under CSISA-BD for Barisal hub	Executive director, BDS	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	9,009
5.	MoA between WF and RENAISSANCE (Samaj Seba Sangstha) under CSISA-BD for Khulna hub	Executive director, RENAISSANCE	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	7,400
6.	MoA between WF and Tengamara Mohila Sabuj Sangha under CSISA-BD for Khulna and Rangpur hubs	Executive director, TMSS	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	38,849

7.	MoA between WF and Society Development Committee under CSISA-BD for Faridpur hub	Executive director, SDC	Collaborate to implement CSISA-BD activities on improving aquaculture farming technologies among wider farmers' groups through training and demonstration and other extension approaches.	October 2013	September 2014	15,993
8.	Agreement between Participatory Management Initiative (PMID) in association with Bangladesh Centre for Advanced Studies (BCAS) and CSISA-BD project	Md. Rafiqul Islam, managing partner, PMID	Annual survey for technology adoption of the project-supported farmers	November 2013	May 2014	9,917
	Total	**8**				**234,362**

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