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CEREAL SYSTEMS INITIATIVE FOR SOUTH ASIA (CSISA)

From:

International Maize and Wheat Improvement Center (CIMMYT)

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LIST OF ACRONYMS AND ABBREVIATIONS

ABCD	**Full Name of Acronym**
2WT	Two-wheel tractor
AIC	Advisory and Investment Committee
ARTC	Adaptive Research and Training Center
BARI	Bangladesh Agricultural Research Institute
BHU	Banaras Hindu University
CA	Conservation agriculture
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal Systems Initiative for South Asia
CSISA-BD	CSISA-Bangladesh
CSISA-M.I.	CSISA Mechanization and Irrigation project
CSISA-NP	CSISA-Nepal
CSSRI	Central Soil Salinity Research Institute
CT	Conventional tillage
DADO	District Agriculture Development Officer
DOA	Department of Agriculture
DSR	Direct-seeded rice
DWR	Directorate of Wheat Research
EC	Executive committee
EUPH	Eastern Uttar Pradesh hub
FTF	Feed the Future
HYP	High yield potential
HYV	High-yielding variety
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICAR-RCER	ICAR-Research Complex for Eastern Region
ICRM	Integrated crop and resource management
ICT	Information communication technology
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IRB	Institutional Review Board
IRRI	International Rice Research Institute
JEEViKA	Bihar Rural Livelihoods Project
JNU	Jawaharlal Nehru University
KVK	Krishi Vigyan Kendra
LoA	Letter of agreement
MT	Management team
MTUPR	Machine-transplanted unpuddled rice
NARC	Nepal Agricultural Research Council
NARES	National agriculture research and extension systems
NGO	Non-governmental organization
NREGA	National Rural Employment Guarantee Act
NSC	Non-structural carbohydrate
NWRP	National Wheat Research Program
OFSP	Orange-fleshed sweet potato
OPV	Open pollinated variety

PAU	Punjab Agricultural University
QTL	Quantity trait locus
RAF	Regional Agricultural Forum
SP	Service provider
TNAU	Tamil Nadu Agricultural University
TRRI	Tamil Nadu Rice Research Institute
UAS	University of Agricultural Sciences
UBKV	Uttar Banga Krishi Viswavidyalaya
USAID	United States Agency for International Development
VAW	Village agricultural worker
VDC	Village Development Committee
WRC	Wheat Research Center
ZT	Zero tillage

EXECUTIVE SUMMARY:

In recent years, gains in cereal productivity in South Asia have slowed markedly and, simultaneously, issues of resource degradation, declining labour availability, and climate variability pose steep challenges for achieving sustainably intensified cereal systems that meet the dual goals of improving food security and rural livelihoods. To address these challenges, the Cereal Systems Initiative for South Asia (CSISA) was established in 2009 to pursue a set of interventions with an integrated systems approach designed to catalyze durable change at scale in South Asia's cereal systems. Operating in rural hubs in Bangladesh, India, and Nepal, CSISA involves more than 300 public, civil society, and private sector partners in the development and dissemination of improved cropping systems, resource-conserving management technologies, new cereal varieties and hybrids, livestock feeding strategies and feed value chains, aquaculture systems, and policies and markets. The project is composed of six objectives: (1) Catalyzing widespread dissemination of production and post-harvest technologies to increase cereal productivity, resource use efficiency, and income; (2) Process-based research into crop and resource management practices for future cereal-based systems; (3) High-yielding, heat- and water-stress-tolerant rice varieties for current and future cereal and mixed crop-livestock systems; (4) High-yielding, heat- and water-stress-tolerant, and disease-resistant wheat varieties for current and future cereal and mixed crop-livestock systems; (5) Improved policies and institutions for inclusive agricultural growth; and (6) Improved project management, data management, monitoring and evaluation, and communications.

In the past six months, CSISA has made steady progress towards the goals set out in its results framework (Appendix A). In India, CSISA has successfully promoted early wheat sowing and zero tillage as best management practices in Bihar, reaching more than 9,000 farmers in 2012-2013. It has supported more than 580 zero till service providers with technical and business skills training, accelerated work with women farmers on maize-based intercropping and small enterprise formation, and introduced machine transplanting and community nurseries for rice, with the former providing an important adaptation strategy for coping with climate variability and change. In Eastern Uttar Pradesh, CSISA has promoted long-duration wheat varieties, hybrid rice varieties, machine transplanted unpuddled rice, and Kharif maize. In Odisha, CSISA has begun collecting data for the development of Nutrient Manager tools for rice and maize, which will enable site-specific nutrient management to be practiced in the state.

CSISA has strengthened strategic partnerships with the state Department of Agriculture, the Krishi Vigyan Kendras (KVKs), state agriculture universities (SAUs), NGOs, and local service providers as needed for the promotion of locally appropriate resource-conserving technologies and better-bet agronomic practices that can be implemented at scale. CSISA has also formed partnerships with the private sector to support dealer training – an essential activity that supports the most common source of information and advice for most farmers in India. Perhaps most importantly, CSISA is forging a new alliance with JEEViKA in Bihar JEEViKA is supported by the National Rural Livelihoods Program and has tremendous reach into communities across

Bihar. They are collaborating with CSISA on issues such as women's empowerment and business development services as well as with general training on agronomic basics though their existing field staff and community presence.

In Bangladesh, CSISA has provided 128,340 farmers with new Boro (dry) season rice varieties tolerant to saline soils, and introduced new short-duration Aman (monsoon) season rice varieties into the cropping system, allowing farmers to fit a third mustard crop between the Aman and Boro rice crops. Other CSISA activities in Bangladesh include the promotion of crops that require less irrigation than Boro rice, such as wheat, maize and sunflower; the promotion and facilitation of mechanized planting using two-wheel tractor-drawn strip till planters and bed planters; the promotion of irrigation interventions using axial flow pumps, which use only two-thirds of the fuel to pump water as conventional pumps; and the formalization of collaborations with NGOs and private sector partners that facilitate the widespread out-scaling of technologies.

In Nepal, CSISA implemented on-farm lentil trials to assess the effects of improved practices and spring maize trials with new hybrids and farm varieties to assess their performance under different management practices. The project also facilitated access for women farmers to women-friendly, scale-appropriate machinery, including two-wheel tractors and rice and wheat harvesting equipment.

Cross-cutting activities included the field evaluation and fine-tuning of a *Nutrient Manager for Tamil Nadu* tool; the formalization of partnerships to promote community-based extension in Odisha; the promotion of improved post-harvest practices and viable business models across the CSISA domain; the promotion of small-scale mechanization; and the development of improved livestock feed mixing and distribution enterprises through self-help groups in Bihar.

Objective 2 has derived results from three years' worth of Phase I studies across the project's four research platforms, and has developed key messages for different regions of the Indo-Gangetic Plains. For Northwest and Eastern India, CSISA has highlighted the beneficial impact of conservation agriculture practices on resource conservation and system productivity, and the viability of direct seeded rice as an alternative to transplanted rice. In Northwest India, Kharif maize appears to be a suitable and profitable alternative to rice, and in Eastern India, a rice–maize+potato–relay cowpea cropping system appears to be a profitable, albeit labor-intensive, cropping system. In Tamil Nadu, both machine transplanted rice in unpuddled soil and direct seeded rice are viable alternatives to manual transplanting in addressing labor constraints and rising production costs. In Bangladesh, best-bet crop management practices known as Integrated Crop and Resource Management for irrigated Boro and Aman rice have been developed and are ready for dissemination at scale. Crucially, research results from all the platforms demonstrate that high cereal yields can be attained while saving considerable amounts of labour, water, and energy, while increasing profitability.

Objective 3 has made steady progress towards developing elite rice lines with increased yield potential, improved grain quality and superior feeding value, rice for mechanized direct seeding and water-saving irrigation practices, and high-yielding heat-tolerant rice. The major activity was the production, crossing, and evaluation of thousands of rice lines in order to select for desirable characteristics. Objective 4 has undertaken similar activities—breeding trials and nurseries—in pursuit of high-yielding heat- and water-stress tolerant, and disease-resistant wheat varieties for current and future cereal and mixed crop-livestock systems. Objective 4 work has resulted in new wheat varieties being promoted to national and state trials for their evaluation and subsequent release, and the approval of a new wheat variety for release in the state of Punjab in India.

Objective 5 continued to address the policy environment needed to remove constraints to the adoption of new technologies and enhance the benefits of improved agricultural growth. CSISA undertook studies on market segmentation strategies for new technologies based on field experiments with laser land leveling in eastern Uttar Pradesh, the impacts of the National Rural Employment Guarantee Act on adoption of resource-conserving technologies, farmers' preferences for abiotic stress tolerance traits embodied in different rice backgrounds, and farmers' attitudes toward risk and ambiguity.

Under Objective 6, a variety of regional, country-level, and state-level governance and management mechanisms were implemented, including the establishment of an Executive Committee for CSISA regionally, Management Team meetings for India and Bangladesh, and Advisory and Investment Committees for Bihar, Odisha, and Bangladesh.

CSISA has faced a number of key challenges in the countries in which we work, including in the current volatile political climate in Bangladesh and the preponderance of *Hartals*, and the periodic flare up of *bandhs* in Nepal. CSISA has taken multiple contingency measures in each of these situations in order to maintain the momentum of the work.

CSISA has improved its M&E capacity, and has implemented new estimation techniques for the evaluation of Rabi season crops, as well as some deeper-dive studies into direct-seeded rice adoption in Bihar and Uttar Pradesh and the characterization of zero-till service providers in Bihar.

Over the next half-year, in addition to the continuation of activities under Objectives 1-6, CSISA will be launching a new USAID/Bangladesh funded project called, "Sustainable Intensification of Agricultural Systems in Southern Bangladesh," which focuses on irrigation and small-scale mechanization. This award will be run as a sub-initiative of the larger CSISA project, is expected to begin operations in mid-2013, and aims to transform agriculture in by unlocking the potential productivity of the region's farmers during the dry season.

I. Program Overview and Performance

A. Results Framework

The CSISA Results Framework has been placed in Appendix A.

B. Key Accomplishments and Developments during this Quarter

The Cereal Systems Initiative for South Asia (CSISA) was established in 2009 to pursue interventions with an integrated systems approach designed to promote durable change at scale in South Asia's cereal systems. The project contains six objectives: (1) Catalyzing widespread adoption of production and post-harvest technologies to increase cereal productivity, resource use efficiency, and income; (2) Crop and resource management practices for future cereal-based systems; (3) High-yielding, heat- and water-stress-tolerant rice varieties for current and future cereal and mixed crop-livestock systems; (4) High-yielding, heat- and water-stress-tolerant, and disease-resistant wheat varieties for current and future cereal and mixed crop-livestock systems; (5) Improved policies and institutions for inclusive agricultural growth; and (6) Improved project management, data management, monitoring and evaluation, and communications.

Objective 1: Catalyzing widespread adoption of production and postharvest technologies to increase cereal production, resource efficiency, and incomes

Objective 1 focuses on achieving both short- and long-term impact on sustained cereal production growth by reducing yield gaps, accelerating the adoption of innovative technologies, forming private- and public-sector partnerships, employing sustainable business models and information systems, and undertaking additional activities that achieve impact at scale. The core of CSISA is its 'innovation hubs,' which integrate multidisciplinary teams and activities and form partnerships that allow CSISA to develop locally-relevant, scalable, and sustainable interventions. The Objective 1 hubs in India are located in Bihar, Eastern Uttar Pradesh, and Odisha; in Bangladesh they are centered in Khulna, Jessore, Barisal, Faridpur, Rangpur, and Mymensingh Districts; in Nepal, activities are concentrated in Banke, Dadeldhura, Achham, and Surkhet District. Anticipated outputs of Objective 1 include participatory testing and technology refinement for sustainable intensification; translating research into actionable products and insights; mobilizing partnerships for catalyzing impact at scale; and strategic capacity development to support key agents of change.

INDIA

Bihar Hub

During the recent Rabi(winter) season, the Central Bihar Hub prioritized the promotion of **early wheat sowing** with accompanying best management practices, greatly expanding the area under timely wheat establishment which is an essential adaptation measure for coping with

contemporary and projected climate stresses in the Eastern Gangetic Plain. Achieving broad-scale adoption of wheat sowing by November 15th provides a foundation for sustainable intensification of cropping systems productivity in Bihar, as well as a decisive break from past practices as state recommendations specify that wheat sowing should begin on or after November 15. The hub experienced larger than expected adoption of early wheat sowing amongst its target populations, facilitated by zero tillage technology. During 2012–13, the Bihar hub expanded its impact significantly, from reaching 3,000 farmers in rice, wheat, and maize in 2011–12 to more than 9,000 farmers (covering about 8,000 ha) in early sowing and zero tillage wheat alone. Early wheat sowing intervention protected wheat against the terminal heat event that occurred at the end of March 2013; quantification of on-farm yield gains is in process. This success story is being realized across the hub domain area, with the trend towards early sowing more prominent in Begusarai, Lakhisarai, Samastipur, and Vaisalli districts.

The involvement of **service providers (SPs)** has helped tip the scale in favour of early sowing as a best management practice for wheat in Bihar. For example, 588 service providers were assisted with technical and business development advice by the Bihar hub during the wheat season of 2012–13, compared to 110 during the last three years. Additionally, with mentorship from CSISA another 10 service providers provide laser land levelling and four provide machine transplanting of rice, a technology newly introduced to the Bihar hub domain area CSISA. Through its partners, the hub is setting up and sustaining the network of SPs by improving their technological and business skills and knowledge. Farmers are showing more interest in mechanization and therefore turning their attention to providing custom services as an alternate source of income. In the presence of service providers, small landholders do not need to invest in tractors or new machines as they can turn to SPs, who can offer rental services from seeding to harvesting. In this fashion, smaller farmers can realize the benefits of new technologies without the financial burden of purchasing expensive machinery. CSISA endeavours to democratize access to advanced technologies through supporting the emergence of service providers. Crucially, training support has been undertaken with the full partnership and support from the State Department, who increasing understand the importance of supporting key intermediaries such as service providers as ‘agents of change’. This change in outlook is partially attributable to the influence of CSISA in Bihar.

The CSISA Bihar hub and its partners, including NGOs, have begun to focus their attention on the involvement of **women farmers** in its work. Out of 650 farmers, 224 women farmers participated in the area expansion of maize-based intercropping of peas and potato. Seed production of four wheat varieties was taken up by two NGOs. We also plan to foster the emergence of women entrepreneurs to form new small businesses that provide critical services such as weed control and precision fertilizer application.

During this reporting period, the area expansion of **direct-seeded rice (DSR)** under conventional tillage (CT) was hindered by a drought-like situation in 2013 as the first monsoon shower was received after the sowing time had lapsed. Due to late rains, 51 cases of crop failure were

observed in DSR fields in the hub domain. The average paddy yield under machine transplanted unpuddled rice (MTUPR), DSR, and manual transplanting were 4.82 (N= 46), 3.67 (N=96) and 3.24 (N=16) t/ha, respectively. The corresponding paddy yields of hybrids under MTUPR and DSR were 5.13 and 3.78 t/ha and that of varieties at 4.30 and 3.58 t/ ha, respectively. The paddy yields of hybrid rice were higher than non-hybrids; current trends signal an increasing acceptance of hybrids by farmers in Bihar.

The grain yield of maize hybrids (Dekalb double and Dekalb 70-74) were greater under **bed planting** at 3.36 t/ha (N=50), as compared to 2.77 t/ha (N=10) under zero tillage (ZT), and 2.55 t/ha under CT. These results highlight the importance of innovative agronomy to close pervasive yields gaps as the average maize grain yields in the hub domain area was characterized as 1.55 t/ha.

The hub revisited its strategy for addressing low productivity in rice-based cropping systems. **Machine transplanting** and the concept of **community nurseries** have been introduced. The State Department of Agriculture has accepted these recommendations and has targeted 200 acres in each district for evaluating community nurseries and machine transplanting of rice. Community nurseries are a particularly important innovation since the transplanting of old seedling is a binding constraint to rice yields in rainfed areas where monsoon onset governs transplanting times. By selling seedlings of multiple ages, these nursery enterprises ensure that farmers will consistently have access to seedlings that can be transplanted at the optimal time which, in turn, will help ensure high rice yields and resource use efficiencies.

After looking at knowledge gaps within different extension agencies, the CSISA Bihar hub and its partners provided **training** on conservation agriculture-based technologies and better bet agronomy to 329 extension personnel from the Department of Agriculture (DOA), 147 service providers, 578 farm advisors, and 1,238 farmers—including 191 women—between October 2012 and March 2013.

Eastern Uttar Pradesh Hub

The Eastern Uttar Pradesh hub (EUPH) promoted **long-duration wheat** varieties, encouraging 2,702 farmers to adopt these varieties (PBW 343, PBW 502, HD 2733, HD 2824, HD 2967, and DBW 17) under early sowing conditions, with 1,895 farmers employing conventional tillage and 807 farmers undertaking zero tillage (ZT). A total of 1,682 farmers adopted zero tillage, taking into account all planting times and varieties. A total of4,384 farmers employed a package of three best management practices (early sowing, zero-tillage, and long duration varieties). Total area under zero tillage and early sowing under CT was 2,040 and 1,118 ha, respectively.

The number of farmers adopting **hybrid rice** (dominated by Arize 6444 and PHB 71) was 976, covering 503 ha. Seven hundred fifty-one farmers, covering an area of 584 ha, adopted direct seeded rice. One hundred seventeen farmers, covering an area of 164 ha, adopted machine transplanted unpuddled rice. Based on data collected from 260 DSR plots, 124 MTUPR plots,

and 148 farmers' reported puddled rice plots, paddy yield across hybrids or varieties were 5.8, 6.3, and 5.5t/ha, respectively. The corresponding paddy yields in hybrids were 6.6, 7.2, and 6.1 t/ha, while in varieties corresponding paddy yields were 5.6, 6.0, and 5.5 t/ha.

Prior to the inception of CSISA in 2009, very few modern and safe herbicides were available in the market in Eastern India. CSISA has worked with the private sector to expand both the availability and best use practices for modern herbicides. A market survey of 64 input dealers in the EUPH domain showed that the market for bispyribac—a **DSR herbicide**—increased from 15,900 litres in 2011 to 21,200 litres in 2012. The corresponding area coverage of this herbicide in 2012 was 84,800 ha (at 250g product/ha).

CSISA has also identified important opportunities to increase cropping intensity (i.e. number of crops per year). Field demonstrations of *kharif* maize on beds were conducted in 68 farmer's fields, including 16 farmers with intercropping. The average grain yield of sole crops of maize was 4.0 t/ha and maize-equivalent yields of intercropped (maize + turmeric)-based systems was 11.0 t/ha. In one village (Pokharbinda in MaharajGhanj district), farmers were encouraged to take up short duration rice followed by brassica, followed by *mentha*. Acreage for such intensification is set to rise further.

Capacity building was expanded through the involvement of dealers and distributors (48), field officers and extension personnel (52), and farmers (825)—including women farmers (110). The CSISA EUPH collaborated with the Department of Agriculture, *Krishi Vigyan Kendra*s (KVKs), agro-dealers, a state agriculture university, NGOs, and local service providers (136 for zero tillage, 11 for laser land leveller, and nine for MTUPR).

Odisha Hub

CSISA activities in Odisha started with **demand analysis** studies for an 'Initial prioritisation within the context of livelihoods of resource-poor farm households' in Puri and Dhenkanal districts using participatory rural appraisal methods in October and November. In March 2013 a gender analysis study called the 'Rapid gender need assessment in rice farming practices' was conducted in eight villages of Puri District, involving over 100 women members of seven self-help groups(Figure B1 in Annex B).

Activities on farm mechanization were started with a **training program** for 20 participants from different governmental and non-governmental institutions in January. In the process, demonstration of zero-till establishment for maize and mustard were conducted on the Orissa University for Agriculture and Technology research station in Bhubaneswar after laser leveling the fields. For the first time in Odisha, mechanical transplanting under unpuddled conditions was demonstrated and compared to rice crops in soil puddling that were established by manual and mechanical transplanting.

In Puri district, **mungbean** crops were established with a zero-till seed drill after the rice harvest. In the demonstrations, crop growth was very satisfactory and the yields were at par when compared to conventional farmer's practice with considerable cost savings achieved over conventional systems.

In addition, the required data collection for the development of the **Nutrient/Crop Manager** tool has commenced with the establishment of 40 omission plot and sufficiency trials for rice and maize in Puri and Bhadrak districts and will continue in the upcoming wet season.

During the first six months of the project, scientists from the International Maize and Wheat Improvement Center (CIMMYT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI), and International Rice Research Institute (IRRI) and CSISA staff from other hubs visited Odisha to meet with various stakeholders to assess and to prioritize critical entry points for different agro-ecologies in preparation of a road map for agricultural development in Odisha. These entry points were refined and broadly accepted by partners at the meeting entitled 'Building Linkages for Agricultural Research and Development in Odisha', which was held on May 10th and 11th at the CRRI campus in Cuttack. At this meeting, leadership from the Ministry (National Food Security Mission), State Department, Odisha University for Agricultural Technology, and several other institutions reached consensus on joint activities to be conducted during the upcoming *Kharif* season for nutrient management, post-harvest, rice mechanization, and maize agronomy.

Haryana Hub: Consolidating progress

Along with the Phase I hubs in Tamil Nadu and Punjab, Haryana is a transition region for CSISA in India and receives status quo level of funding and will not have donor support beyond Phase II. As such, strong efforts are being made to consolidate progress to ensure the longevity and associated impact of CSISA's investments.

Through the joint efforts of CSISA Haryana hub and other national/international partners, broad-scale awareness of conservation agricultural has been developed among policy makers, farmers, and the private sector. To translate awareness into action, the Haryana Hub prioritizes the following:

1. The innovation hub model developed by Haryana hub has proven successful in achieving outcomes in the form of ever increasing number of farmers adopting the technologies along with new refining emerging from participatory processes. The synergy established under the aegis of CSISA between farmers, extension workers, scientists, government officer, private companies and policy makers is the key. This model is being shared with other parnters within the state as well as used as an example for other CSISA domains (e.g. Odisha).

2. Scalable training modules on different components of conservation agriculture are being prepared to train the service providers across hubs. These modules will be self-explanatory and user friendly using various simple tools and techniques to facilitate ToT and a broader reach for CSISA through partners.

3. KVK's are responsible for extension activities of the technologies in the national system. They are the core partners of the hub. Trials will continue with the KVK's to generate information about the long term effect of the conservation agriculture technologies, but increasingly are lead by the KVKs themselves.

4. Due to the collaborative efforts of Haryana Kisan Ayog, CSISA hub and other partners, important policies are being influenced in the state like inclusion of CA-based crop management practices in their action plan and conducting large scale demonstrations on these technologies along with increased or new subsidies on conservation agriculture machines.

5. It has been felt that the crop diversification is one of the most important keys in sustainability of Haryana agriculture. CSISA hub along with partners is emphasizing on crop diversification with the inclusion of maize and moong by conducting research experiments, demonstrations, capacity building of the partners/farmers and policy making etc.

6. Selected on-farm trials (OFT's) will be undertaken for further information generation and the technology refinement. The OFT's deal with the problems encountered by the different partners as well as CSISA staff in the technology improvement process.

BANGLADESH

CSISA-BD works through six hubs, of which four are in the Feed the Future focal area of southwest Bangladesh. Each hub represents an agro-ecological zone with distinct cereal system production problems. A major focus of this six-month period, which coincides with the *Rabi* or dry season, has been the creation of opportunities for farmers to grow a second or even third crop on the same land where previously only one or two crops have been possible. It is estimated that some 634,000 ha lie fallow in the lower part of southwest Bangladesh during the Rabi season due to a combination of factors, the principle ones being soil salinity and lack of fresh water for irrigation. CSISA-BD has taken a number of approaches, elucidated briefly below, to resolving these problems.

The introduction of new **Boro season (dry season) rice varieties tolerant to saline soils** have allowed farmers to grow Boro rice in areas where it would not previously have been possible. During this reporting period as part of the CSISA-BD rice seed scale up program (Sustainable Rice Seed Production and Delivery System for Southern Bangladesh project), 128,340 farmers received seed of salt-tolerant varieties. The seed project has conducted demonstrations and

distributed seed of salt-, submergence-, and drought-tolerant varieties, of early maturing high-yielding varieties, and some high-yielding aromatic varieties to 1.06 million farmers over an 18 month period. It is estimated that a further 1.28 million farmer have obtained seed from these farmers through sales and gifts of seed.

Another approach has been to introduce new **Aman season (monsoon season) rice varieties** that mature 35 days earlier than traditional High Yielding Varieties (HYV). This allows farmers to squeeze in a mustard crop between the Aman and Boro rice crops. Last season 2,232 farmers planted high yield mustard varieties on about 300 ha as part of a cropping system that involves the use of new early maturing monsoon rice varieties. This system gives farmers an extra $50 to $80 on the 1/10th ha plot typically owned by Bangladeshi farmers. If, in addition to this, the farmer adopted some of the aromatic, fine-grained HYV rice varieties that are being demonstrated this year, the farmer would reap an extra $40 to $50 from these higher value varieties.

The introduction of **crops that require less irrigation** than Boro rice such as wheat, maize, and sunflower is another approach being taken by the project. Sunflower and some of the new varieties of wheat tested this year by CSISA-BD also have some tolerance to soil salinity. These crops have been introduced with a package of technologies that will minimize farmers' costs, water use, and soil degradation. This package includes:

Mechanized planting using two-wheel tractor drawn strip till planters or bed planters, which allow for the seeding of crops into crop stubble without the need for ploughing. This reduces both the time taken to establish a crop and the cost of establishment. Farmers using these methods saved $101/ha for maize and $90/ha on wheat production costs this year. Unlike earlier farm mechanization programs in Bangladesh CSISA-BD has not procured and distributed machines to farmers for 'testing' in isolation from the private sector. We have strongly emphasized engagement with machinery companies and dealers and the sharing of some start up costs such as machine operator training and machinery promotion. As a result 101 village-based entrepreneurs bought and were trained on the use of strip till planters as attachments to power tillers by a machinery importer. These entrepreneurs–service providers–have, through the sale of planting services, sown 387 ha of wheat, maize, and sunflower.

Irrigation using axial flow pumps, which use only two-thirds of the fuel to pump water as conventional pumps, have been tested this season and show promise as a low-cost pump for pumping fresh water from ponds, lakes, and canals. If used to irrigate low-water-requiring crops such as wheat, maize, and sunflower, these water bodies can be used much more efficiently than if they were used to irrigate Boro rice.

Sunflower shows potential as a new high value oil seed crop that has the advantage of being drought and saline soil tolerant. It was successfully grown by 122 farmers by either planting by 'dibbling' with a planting stick into rice stubble immediately after rice harvest or by using strip

till and bed planter equipment. Despite a growing demand in Dhaka supermarkets for high quality, cholesterol free cooking oil marketing has been a problem. To investigate this problem CSISA-BD conducted a simple value chain analysis of the sunflower seed supply and crop marketing chain and determined that the main problem is that the quantity of sunflower produced is not yet sufficient to encourage local oil press owners to adapt their oil presses to sunflower oil production. The national NGO BRAC, though, has started to invest in sunflower oil processing and will buy whatever is produced. It is anticipated that creating this market will stimulate production and this, in turn, will create the volumes that will encourage other oil press owners to enter the market.

Orange Fleshed Sweet Potato (OFSP) has been introduced this season as part of the aquaculture systems being tested by CSISA-BD. This high vitamin A content root crop adds to the range of interventions the project is making that are aimed at raising the nutritional value of farmers diets, as well as the production of high value crops. This is done through OFSP and vegetable production demonstrations on the margins of fish ponds and fish/rice ponds (Ghers). Related to this has been the development of methods for raising vitamin A rich Mula fish in ponds. This small indigenous river fish is a highly prized fish in Bangla diets but has in recent years become scarce in rivers and lakes.

Studies have been initiated to develop a better understanding of post-harvest processes on female labor demand and to determine losses in quality of rice seed stored by farmers. A study has also been initiated to determine the impact of fish cage culture on female labor availability.

Drying large quantities of seed at the end of the harvest season was identified as a major constraint for the rice seed industry in a value chain analysis of the rice seed industry. Failure to dry the seed down quickly results in rapid seed quality degradation. One solution to this might be to use grain driers. To test this CSISA-BD is working with a seed growers association in Jessore to construct a five ton capacity **‘flat bed’ grain drier**. This simple hot air fan drier uses rice husks as fuel to heat the air. If this experiment, financed by the seed association, is successful it is anticipated that other seed companies, rice millers and perhaps farmers groups will copy this design and build their own driers.

To assist fish farmers to obtain fare prices for their fish CSISA-BD has started to collect **fish market prices** and transmit these to fish pond owners through extension staff. This data already shows clear fish price peaks in July and January, indicating marketing opportunities during these months. CSISA-BD has also initiated during the reporting period a comprehensive study of the economics of fish farm production which will allow the program to compare the income gained by fish farmers who are using CSISA-BD introduced technology with farmers who have not yet adopted this technology. The results of this study will be available during the next reporting period.

CSISA-BD began to collaborate during this reporting period with women who sell farmers web-based information. These women, known as **'Info Ladies,'** were given training in the use of web-based agriculture and aquiculture information sources to add to their existing information sources which are largely health-, education-, and government information-based.

CSISA-BD implements **technology scale out (extension) programs** through 34 NGO and private sector partners (not including the rice seed scale out program). Not only does this allow CSISA-BD to reach a large number of farmers, it also allows the core CSISA-BD staff to concentrate on technology testing and development. During this reporting period 47 new Letters of Agreement(LOAs) were signed with partners, worth in total $532,020.

CSISA-BD also has nine LoAs worth $85,546 with Bangladesh Rice Research Institute, Bangladesh Agricultural Research Institute (BARI), and Bangladesh Institute of Nuclear Agriculture to finance plant breeding and research activities and one LOA with BARC worth $60,000 to finance Ph.D. and Masters degrees.

During this reporting period CSISA-BD initiated a scheme to provide **young women scientists** with internship grants that will allow them to conduct field studies that will be used to provide data for their post graduate thesis. One student has begun a post harvest study and a further six internships are planned which will study fish-related issues.

The CSISA-BD **baseline survey** and the evaluation of the rice seed out-scaling project were completed through contracts with the Bangladeshi consulting company Socio-Consult. Data from both surveys is currently being analyzed.

Detailed **maps** were generated using new field-based plant growth monitoring equipment, satellite imagery, and GIS software to show the extent of fallow land, fresh water bodies, and saline and flood-prone areas in southwest Bangladesh. These data will allow CSISA-BD and other development programs to better target interventions and to monitor changes in land use and the extent of abiotic stress-prone areas over time.

In the previous two years of this project CSISA-BD has trained 46,717 farmers. In this six-month reporting period alone CSISA-BD trained 37,928 farmers. CSISA-BD anticipates that during the life of CSISA 300,000 farmers will adopt new technology through participation in field days and farmer to farmer information and technology transfer.

NEPAL

CSISA-Nepal (CSISA-NP) project activities are focused on USAID's Feed the Future (FtF) mandate crops in Nepal (lentil, maize, rice), and began with the lentil season in October 2012. Adaptive Research and Training Center (ARTC, equivalent to CSISA hubs) locations were chosen based on a number of agronomic, socioeconomic, and logistic factors, and the project now has an ARTC in each of four districts. The Terai office is in Banke, and mid-hills offices are

in Dadeldhura, Achham, and Surkhet. Sites for on-farm field trials were selected using a short survey and discussions with the District Agriculture Development Officer (DADO).

On-farm lentil trials were implemented in October 2012 to assess the effects of improved practices compared with those typically employed by farmers: newer improved varieties vs. saved seed; line vs. broadcast sowing; seed priming and *Rhizobium* inoculation vs. no seed treatment; and recommended NPK rates vs. no NPK. Through much of the season the establishment and vigor of improved lentil, regardless of variety, was better than farmer variety, with line-sown lentil performing better than similar but broadcast treatments. Primed and fertilized farmer lentil also showed better vigor than unprimed farmer seed with or without fertilizer. However, unseasonal heavy rains soon after flowering decimated lentil crops across the western Terai, with heavy losses due to root rot—but these rains were beneficial for trials in the mid-hills site, where there is no irrigation. Following these rains, improved lentil varieties consistently displayed higher incidence of rot, while the farmer's variety typically looked better. Farmers could not recall having bought seed, but reported always using saved seed—which, despite its low yield potential, is likely to be resistant to a variety of stresses after years of selection in the field. For the next lentil season, bed planting will be implemented in the Terai to protect the crop in the event of heavy rain, and enable improved varieties to achieve their yield potential. All lentil trials have now been harvested, and data on nodulation, weeds, and yield is being analyzed.

Recognizing that the seed sector in Nepal needs to be strengthened, **spring maize trials** with new hybrids and farmer varieties and seed drill demonstrations/trainings were implemented with a total of 82 farmers in Terai and river valley sites in close collaboration with three seed companies (Unique Seed Co., Panchashakti Seed Co., and Global AgriTech Enterprises--GATE) with local offices. Involving seed companies is a new approach to bring seed suppliers and buyers into closer contact in the field, to raise the capacity of company technical staff to raise awareness of farmer needs and constraints, and ideally, make companies more responsive to farmers. The trials assess the performance of several hybrids vs. farmer OPVs under line sowing and recommended nutrient management. The maize is now tasseling, and farmers express enthusiasm about the hybrids, and are eager to assess green cob and grain yield. They prefer line sowing over the traditional broadcasting saying that line-sowing (a) results in a more uniform stand; (b) saves time and labor during weeding; and (c) increases efficiency during irrigation. Assuming assured irrigation for the next maize season, many farmers have expressed a desire to convert currently fallow land to maize hybrids under these improved practices.

A village survey instrument was developed, pre-tested, refined, and administered in experimental sites; these data are currently being analyzed. A **participatory market chain analysis** focused on three Terai districts (Kailali, Banke, and Dang) to understand opportunities and constraints for strengthening seed systems and making markets work for smallholders. Separate focus group discussions were conducted with all grain and seed value chain actors for lentil, maize, and rice.

Seed producer groups, seed companies, and Agrovets were also interviewed. Data entry and analysis of these surveys is ongoing.

A critical intervention to address labor shortages and the increasing 'feminization' of agriculture is to provide access to **women-friendly, scale-appropriate machinery**. Farmers of the central Terai have responded to labor prices and crunches at key periods by buying and/or hiring machinery. For reasons we don't fully understand yet, many established agriculture machines are not available in the mid and far west. CSISA-NP is addressing these issues by developing a short survey to assess the market and also rolling out a mechanization program that includes demonstrations such as:

- 2-wheel tractor (2WT) maize seed drill demonstration in Bardiya (Aauri VDC, MagarGadi village) with 16 farmers; 5 farmers sowed their own fields with this drill
- Trainings/demos on rice and wheat harvesting equipment were held in Banke and Bardiya, with CSISA-NP staff, the Agricultural Engineering Directorate of DoA, and a local machinery dealer. Small-scale machinery like the 2WT reaper-harvester, mini-combine harvester, and powered sickle or brush cutter were demonstrated (FiguresB2, B3, B4 in Annex B). During the preparation and the coordination for this small scale demonstration CSISA, DoA, and Nepal Agricultural Research Committee (NARC) discussed preparing for a much larger demonstration for the coming rice season that will involve more machinery, more districts, and the FtF-KISAN project.
- Discussion was initiated with partners (DoA' s Agricultural Engineering Directorate and NARC's Agricultural Engineering Division, and the Nepal Agriculture and Environmental Forum) on starting an occupational health and safety program for safe use of farm machinery. Informational posters and pamphlets similar in style to US state farm safety programs and sponsorship of local FM radio programs (and safety jingles) timed with dangerous field operations are being considered.

CROSS-CUTTING OBJECTIVE 1 ACTIVITIES

In Phase II, CSISA has begun strengthening work teams to include specialists from different disciplines to support decision-making tools, build partnerships, improve post-harvest technologies, increase mechanization, and facilitate livestock-related business opportunities for women. Select activities below highlight some of the progress on themes and activities that transcend the hub and country locations.

Tools to support decision-making: Nutrient Manager

Field evaluation and fine-tuning work for the *Nutrient Manager for Tamil Nadu* has continued with Tamil Nadu Agricultural University during the Thaladi rice season (October 2012 to January/February 2013) that coincides with the North-East monsoon in Tamil Nadu. The obtained results provided valuable information for better understanding the contribution of locally available organic fertilizer sources towards the fertilizer needs of the rice crops. Now a

more precise inorganic fertilizer recommendation can be provided for a given attainable yield level in the presence of organic inputs. This reduces the risk for detrimental effects on the environment by overuse of fertilizers but also increases farmers' income.

Field evaluation during the upcoming rice seasons of 2013/14 – Kuruvai (June to October 2013), Thaladi (October 2013 to January/February 2014)and Samba (August 2013 to January/February 2014) – will continue with Tamil Nadu Agricultural University with the aim to have the *Nutrient Manager for Tamil Nadu* available for dissemination by the Kuruvai season 2014 (Figure B5 in Annex B). In preparation for this, the interface of the *Nutrient Manager* tool was upgraded through HTML 5 programming allowing now the unrestricted use on mobile devices irrespective of the operating system.

The recent CSISA evaluation work also became witness of the continuing water crisis in Tamil Nadu (Figure B6 in Annex B) and its effect on rice production in the State that has manifold causes:

- Changes in the distribution pattern and increased erraticism of monsoonal rains,
- Unreliable release of canal irrigation water from the neighboring state of Karnataka,
- Frequent power outages that restrict irrigation water access in tubewell irrigated areas, and
- Depletion of groundwater resources through excess irrigation

Therefore, efforts will be made to combine labor- and water-saving crop establishment technologies such as dry-seeded rice and unpuddled mechanical transplanting, as well as more sustainable methods of crop irrigation by alternate wetting and drying with location-specific fertilizer recommendations. By integrating advice for resource-conserving management practices that were developed and disseminated by CSISA, the concept of the *Nutrient Manager for Rice* could ultimately by extended to a *Crop Manager for Rice*. The tool could then provide decision support to mitigate risks associated with water shortages by e.g. recommending the combination of a shorter duration variety with resource-conserving establishment methods in tail-ends of canal irrigated schemes that previously witnessed terminal drought events.

Building partnerships for community-based extension: Digital Green in Odisha

In Odisha, the State Government recognizes that a gap exists between research conducted in contained or simulated agricultural environments and its application onto farmers' fields. The presence of this gap has led to the capacity-building/strengthening support of extension-based efforts. One such entity that the government is interested in strengthening is the KVKs. Since KVKs play a double role of interacting with individual farmers on multiple production-related issues, and considering that KVKs are also involved in providing technical support to farming households, avenues to strengthen their capacities need to be explored. It is in this context that Digital Green and CSISA are proposing to work with the KVK technology platform and as the Village Agricultural Workers (VAW) extension system within the state with the Department of

Agriculture, Government of Odisha, generating locally-appropriate and locally-produced agricultural training videos used to increase the technical capacity of the KVKs and the VAWs.

The work will be tested out in a pilot project in Puri District, and Digital Green will bring in its experience of working with the state livelihood projects in Andhra Pradesh (Society for Elimination of Rural Poverty), Bihar (Bihar Rural Livelihood Program), DPIP Madhya Pradesh, and its experience of working with IRRI both globally and with CSISA (Bihar) in Phase I. The objective of this pilot project is to increase the scale of access for farmers to improve crop production technologies by integrating the Digital Green ICT-based extension model with the current KVK and Government of Odisha extension systems.

The project is titled 'ICT-based intervention for extending KVK-promoted technologies to the farmers for improving crop productivity in Odisha' and the main objectives are to:

1. Examine the feasibility of integrating Digital Green's ICT-based extension model with the classical extension system of KVKs and the extension system of Govt. of Odisha.
2. Enhance crop productivity by disseminating improved technologies of KVKsand CSISA.

The ICT model will be integrated in 20 villages (including the 5 villages that have been adopted by the KVK structure in Puri district). In each village there will be two self-help groups, each group consisting of 20 people. Approximately 800 households will be targeted. 10 key agriculture interventions will be targeted for dissemination and the pilot is proposed for Kharif and Rabi 2013/14.

Improving post-harvest practices and viable business models

In India, CSISA focuses on postharvest operations at the farm and household level in relatively poor underdeveloped geographies within the eastern states of Bihar, Odisha, and later in the year will extend its activities into Eastern Uttar Pradesh—where basic knowledge of best postharvest practices and access to improved technology options are major constraints. An initial assessment, begun in late 2012, reveals increasingly severe bottlenecks and losses amongst resource poor farm households. Reducing losses would enhance household food security and increase incomes by recovering more rice and more value from harvests, with reduced drudgery in the process.

Across Eastern India and Bangladesh, post-harvest processing at the household level is predominantly done by women. Improved technology options, such as mechanical threshing, will be promoted as inclusive entrepreneurial business models through local partners to target groups for pilots, data collection, monitoring and support. Drying and storage losses of paddy and seed are additional areas identified for research and remediation options in these regions.

In Bihar, JEEVIKA, Aga Khan Rural Support Programme India, and Grameen Development Services, have been identified for collaborative pilots and learning activities along with national agriculture research and extension system (NARES) partners. In Odisha, international and local

NGOs have been identified, including Catholic Relief Services and its local partners, Pragati and Pradan.

These organizations are currently assisting CSISA to conduct household level surveys and focus group discussions with their farmer groups to define joint activities for piloting, training, and raising awareness of postharvest losses and remediation options. Technology options including mechanical threshing and mechanized drying will be verified and adapted to suit local conditions, and actor-specific activity based business plans will be developed for sustainable adoption and delivery. This is expected to reduce losses and improve quality of seed, paddy, and maize, along with safer household level storage. Farmers will thus have more choices when and whether to sell or consume grain, or buy, use, or exchange, high quality seed.

In both locations, adoption of income-generating business models will be studied as pilots in order to address actor-specific training and extension-related needs. Moreover, activities and pilots earlier commenced by CSISA in neighboring Bangladesh will be leveraged for cross-country learning about technologies and business model options.

In Bangladesh, CSISA has recently piloted a mechanical dryer as a business model with a local private sector entrepreneur (Figure B7 in Annex B).Drying of paddy and seed remain a major bottleneck in processing leading to preventable physical and quality losses. This enterprise is linked to 100 marginal smallholders who are contracted for supply of paddy for processing into high quality seed that is sold to distributors and retailers in Bangladesh's local seed networks. This technology pilot will serve as an exposure and training site to provide farmers local drying services and also to explore drying needs for other crops such as maize.

Facilitating mechanization: Bangladesh workshop

On March 7, 2013, CSISA held a two-day international workshop in Dhaka, Bangladesh entitled 'Rural Mechanization: Policy and Technology Lessons from Bangladesh and Other Asian Countries.' The workshop hosted nearly 100 invited participants and presenters from India, Nepal, and the Philippines, including Bangladesh's Agriculture Minister, the Honorable Matia Chowdhury, as a chief guest, speaking on how far Bangladesh has come in providing smallholder farmers with options in agricultural mechanization. He noted that the easier tasks of mechanizing irrigation, tillage, and rural transportation were accomplished in the last two decades, but that much more needs to be done in mechanizing the remaining agricultural operations of smallholder farmers. Member of the Planning Commission (and workshop co-organizer), MA Sattar Mandal, remarked that timely input delivery and market linkages were crucial to the growth of agriculture, as they essentially converted Bangladesh of the 1970s from international development's basketcase to a food secure nation.

Mahabub Hoosain, BRAC's Executive Director (and former head of IRRI's Economics Division), commented that despite the gains from small farm mechanization, the recent wage rate hikes and outmigration has Bangladeshi farmers scrambling for labor and further cost savings,

particularly in the remaining bottlenecks of rice transplanting and the harvesting of all crops. He added that there is there is a need for sharing information and experiences on mechanization among the South and East Asian countries to help each other in creating the right policy environment. Stephen Biggs, Research Fellow at School of International Development, University of East Anglia, (and former CIMMYT agricultural economist) said that while much research needs to be done, there is mounting empirical evidence that the spread of smaller scale agricultural machinery, has contributed substantially to agriculture and rural development in many parts of Asia and offers lessons for much of the developing world where no revolution has yet reached. PDFs of the presentations are currently available at the links shown in Annex C, while edited proceedings of the workshop should be available later this summer.

Creating livestock-related business opportunities for women

ILRI's contribution to CSISA is organized around cereal residue-based feeding systems, mainly for dairy cattle and buffaloes. Testing, adapting, and improving existing feeding systems requires intensive interactions with farmers, especially as livestock may often be as reluctant to embrace change as their keepers. Intermediate institutions that have credibility with farmers and the capacity to conduct science-based trials are required. In Bihar, CSISA scientists selected local women's self-help groups to implement project activities. These groups had been previously been established mainly for savings and loans activities. Nevertheless, 31 of these groups in Samastipur district showed such interest in expanding into dairy development that they agreed to run farmer feeding trials amongst their members.

Livestock is probably the most important farm domain for women and even in less developed regions selling milk has become a significant source of income. After CSISA Phase I, these groups were so impressed by the effect of feeding improved concentrates that they explored opportunities for getting involved in feed mixing and distribution. One self-help group has developed a proposal to set up a small grinding and mixing unit with a bank loan and their own capital, while the initial stock of raw material is to be purchased based on the project's demand for further farmer trial inputs (which participating farmers buy at a 25% discount). It is expected, based on the demand expressed by the other self-help groups (5 kilograms per day from 300 farmers), that within six months the unit will be able to sustain itself without project support, allowing the project to encourage the establishment of further units in new project areas.

In Bangladesh, the main technology promoted during Phase I of CSISA was chopping of cereal straws to increase feed intake and reduce waste. After initial trials, mechanical choppers were handed over to village entrepreneurs to establish a model for a new service to farmers. Currently, five stationary choppers are run within villages, serving the village itself and its neighbors, while one mobile chopper is taken on a monthly tour through a number of villages. At the moment, the entrepreneurs are only required to record data in return for utilizing the machine. However, during the next phase the project attempts to further promote chopping services by publicizing the developed business model and by linking entrepreneurs with machine manufacturers.

Objective 2: Crop and resource management practices for future cereal-based systems

In the process of participatory development and delivery of conservation agriculture (CA) and other new technologies (Objective 1), problems as well as new opportunities become evident that require both understanding and solutions. Strategic research on these problems and on forward-looking, exploratory solutions is conducted under Objective 2 at four research platform sites: Karnal, Haryana; Patna, Bihar; Aduthurai, Tamil Nadu; and Gazipur, Bangladesh. Research platform activities are conducted in order to (i) assess medium-term performance and sustainability of current and proposed new systems and (ii) continue with dynamic optimization of the proposed new management systems. Four cropping systems scenario treatments were implemented at all four of the CSISA research platforms: (Scenario 1: S1) business as usual—conventional farmers' practices; (Scenario 2: S2) known best management practices (integrated crop and resource management); (Scenario 3: S3) labor-, energy-, and water-saving drivers of change (CA based); and (Scenario 4: S4) futuristic, intensified and/or diversified systems (CA based).

The following points constitute CSISA's primary findings from the research platforms during the reporting period, which are structured around CSISA's key messages for particular regions of the Indo-Gangetic Plains.

Karnal Research Platform (based at the Central Soil Salinity Research Institute - CSSRI):Based on a three-year study at the Karnal platform, CSISA's key messages for the northwestern Indo-Gangetic Plains are that: Full adoption of conservation agriculture-based practices in *rice–wheat–mungbean* (S3) and *maize–wheat–mungbean* (S4) cropping systems are feasible in northwest India without any yield penalty. In fact, conservation agriculture leads to higher system productivity over time (12–14%) with less resource use [water (33–71%), labor, energy (26–46%)] and more profit (22–32% or US$ 394–580/ha/yr) compared to conventional practice (S1) (Figure B8, Annex B). Second, DSR is a viable alternative to puddled transplanted rice to overcome the emerging constraints of labor, water, energy, and the rising cost of cultivation. DSR in S3 yielded similar results to puddled transplanted rice (S1 & S2). Third, maize can be an alternative to rice in northwest India as a Kharif crop under CA, as in S4 it proved to be as productive and equally or more profitable than rice (S1–S3). Fourth, in full CA plots (S3–S4), there were improvements in soil parameters (bulk density, infiltration rate, and soil aggregation).It was noted that in the fourth cropping cycle (2012–13) of wheat, wheat under full CA (S3 & S4) received 20% less N fertilizer and no herbicides for weed control (as plots were almost weed free due to continuous mulching and good weed control) as compared to wheat in conventional till systems.

Patna Research Platform (based at the Indian Council of Agricultural Research – Research Complex for Eastern Region - ICAR-RCER): Based on a three-year study, CSISA's key messages for the eastern Indo-Gangetic Plains are that full CA in rice-wheat systems (S3)

resulted in improvements in wheat and rice productivity by 17% and 8% compared to S2, and 47% and 14% compared to S1, respectively. Second, *rice–maize+potato–relay cowpea* (S4) is a highly profitable system through which 300% cropping system intensity can be achieved, although the system is highly labor intensive. Therefore, mechanization would be needed to make this system socially sustainable. Third, DSR during the Kharif season is a viable alternative to transplanted rice to overcome the emerging labor, water, and energy constraints, as well as rising production costs. DSR (S3) resulted in 15–30% lower irrigation water application compared to puddled transplanted rice (S1).

Aduthurai Research Platform (based at Tamil Nadu Rice Research Institute - TRRI)*:* Based on a three-year study, CSISA's key messages are that machine transplanted rice in unpuddled soil is a viable alternative to manual transplanting in addressing issue labor constraints and rising production costs. Second, DSR is another alternative to transplanted rice to address labor constraints and reduce production costs. Note that after the harvest of thalandi rice (*Rabi* season), the Aduthurai platform will be handed over to TRRI and research activities will be shifted to the new site at the Soil and Water Management Research Institute, Thanjavour, Tamil Nadu.

Gazipur Research Platform: CSISA's key messages from this platform are that the best available crop management and resource use practices (in Bangladesh, referred to as 'ICRM' – Integrated Crop and Resource Management) for irrigated *Boro* and *Aman* rice have been developed and are ready for dissemination at scale. ICRM (S2) increased rice yields by 2.1–2.6 t/ha/yr, net income by US$ 515–805/ha/yr, saved irrigation water by 200 mm and electricity by 300 KWhr/ha/yr compared to S1. Second, machine transplanting was found to be a viable alternative to hand-transplanting rice to reduce planting costs and save labor in the *Aman* season. Third, reduced tillage, unpuddled transplanted rice is also found to be a viable option for cost reduction.

A list of recent publications from Objective 2 can be found in Annex C.

Objective 3: High-yielding, stress-tolerant rice varieties for current and future cereal and mixed crop-livestock systems

Objective 3 develops a new generation of rice varieties and hybrid parental lines for the target regions of South Asia. The target trait specifications used in the variety development pipelines emphasize higher yield potential, adaptation to dry direct seeding and water stresses (partial/non-flooded irrigation), heat tolerance, grain quality, and straw fodder value. Objective 3 provides products for Objectives 1 and 2, including new lines that will be well adapted to CA practices. The information below encapsulates a snapshot of activities conducted under Objective 3.

In pursuit of **elite rice lines with increased yield potential, improved grain quality and superior feeding value**, CSISA Objective 3 conducted the following activities. Twenty-two entries in the medium early maturity and 21 entries in the medium maturity group were evaluated

in multi-location evaluation trials laid out under transplanted conditions. Four entries—AD 04001, PAU 3217, IR 83306-120-1-1-2 and PAU 3129—are promising. In collaboration with ILRI, straw quality of 160 entries including hybrids, varieties, and breeding lines were studied. Based on straw quality parameters like N content, digestibility, and Silicon content, and on animal feeding trials, many promising entries were identified. Multi-location data on straw quality has been generated. In order to develop high yielding varieties with better straw quality traits (dual purpose), promising entries will be used for crossing in the dry season 2013.

In the wet season 2012, 90 varietal crosses were evaluated for increased yield potential, grain quality, and feeding value. Twenty F2 populations were grown and 1500 single plant selections were made. Ten BC1F2 and six BC2F2 populations were grown and 1100 single plant selections were made. Six hundred BC1F3 and 745 BC2F3 lines were evaluated and 450 were advanced to the next generation. Six hundred F5 lines were evaluated and 210 lines were advanced for preliminary yield trial. Eleven hundred F4 lines and 1550 F3 lines were grown and evaluated.

In order to develop **rice for mechanized direct seeding and water-saving irrigation practices**, CSISA conducted three multi-location evaluation trials during the wet season of 2012, under machine-sown, dry direct seeded conditions and including early-,medium-early, and medium maturity duration varieties. The materials consisted of hybrids from private sector companies, breeding lines and varieties from IRRI and public sector NARES partners. Second, CSISA began cropping system-based breeding programs for dry direct seeding, looking for plant types with some of the following characteristics: high grain yield potential; tall stature (> 100 cm); early stage seedling vigor; lower panicle position with strong culm; erect, dark green & prominent top four leaves with slow leaf senescence; long and heavy panicles; prolonged grain filling duration; lower grain shattering with intermediate thresh-ability; biotic stress tolerance; desirable grain quality as per region-specific requirements; and varied maturity groups to suit different cropping systems. In the wet season 2012,125 varietal crosses were evaluated. Thirty F2 populations were grown and 2600 single plant selections were made. Six BC1F2 and 8 BC2F2 populations were grown and 980 single plant selections were made. Four hundred BC1F3 and 550 BC2F3 lines were evaluated and 350 were advanced to next generation. Nine hundred F5 lines were evaluated and 280 lines were advanced for preliminary yield trial. Twelve hundred F4 lines and 1600 F3 lines were grown and evaluated.

In order to develop varieties with anaerobic germination tolerance, mega varieties were crossed with varieties that have quantity trait loci (QTLs) for anaerobic germination tolerance. The 10 F1s were grown during wet season 2012 and five new crosses were made. F2s will be evaluated during wet season 2013. Zinc and iron deficiency is a major problem in dry direct seeded conditions, so110 entries including hybrids were screened for Zn deficiency tolerance. One breeding line from IRRI and a few hybrids were found to be tolerant. A few mega varieties were crossed with the A69-1 (donor for Zn deficiency tolerance) and F1s were evaluated in wet season 2012.

In pursuit of **high-yielding heat-tolerant rice**, Objective 3 has made significant progress in fine mapping the candidate QTLs on chromosome 4 (qHTSF4.1) and QTL on Ch. 1 (qHTSF1.1) has been initiated. For fine mapping qHTSF4.1, 660 BC_2F_2 lines, followed by 1,900 BC_3F_2 lines facilitated N22 fragment from the QTL region to be narrowed down to 5 cM. Further, fine mapping using BC_3F_3 is ongoing. For qHTSF1.1, we are in the BC_2F_2 stage and the fine mapping results are presently being reconfirmed.

Using contrasting genotypes, following a preliminary screen for 36 genotypes to high night temperature impact at the field conditions, we documented a significant decline in the overall biomass, nitrogen content and non-structural carbohydrate (NSC) content and partitioning to the grains leading to reduced yield and grain quality. A key outcome from this work was the differential response of rice to high day (spikelet sterility induced yield loss) and high night temperature (biomass, N, NSC reduced induction of yield and quality loss).

Ninety-four F_2 populations, 3496 F_3 lines, 1026 F_4 lines, 393 F_5 lines, 285 F_5 MAGIC plus lines, and 651 F_6 lines were evaluated in the field for heat tolerance at flowering stage during 2013 dry season. Seventy six lines were advanced to first phase OYT and 76 lines for second phase OYT.A total of 4640 F_3 lines were selected for heat tolerance evaluation at flowering stage in 2013 wet season. Other selections include 2691 F_4 lines, 771 F_5lines, 318 F_6 lines, 210 F_6 MAGIC plus lines, and 222 lines from IR64*2/N22 cross. Ninety-two lines were also selected for observational yield trial. Markers RM80, RM81, and RM85 were identified for QTL selection for heat tolerance. These markers will also be used in developing QTL pyramid lines. Six hundred fifteen F_4 breeding lines were sent to TNAU (India), PAU (India), Iran, Bangladesh, and Colombia for 2013 heat tolerance screening. After field evaluation, selected best performing lines in at least 2 countries will be evaluated under controlled conditions in IRRI. Photos relevant to the Objective 3 breeding work can be found in Figures B9 and B19 in Annex B.

Objective 4: High-yielding heat- and water-stress tolerant, and disease-resistant wheat varieties for current and future cereal and mixed crop-livestock systems

Objective 4 strives to develop bread wheat varieties that improve on those currently available, have higher yields (>5% than current varieties by year 5 and an additional 15% higher by year 10), are well buffered against the vagaries of climate change, and have end-use quality. Objective 4 aims to develop input-responsive varieties that also have greater resistance to biotic stresses such as leaf, yellow, and stem rusts, and spot blotch/leaf blight; as well as better nutritional and end-use quality, and adaptability to CA practices.

Under Objective 4, a large number of **trials/nurseries** from CIMMYT were planted by collaborators in South Asia (Table 1). In addition, ten trials were planted in Pakistan.

Table 1. List of the sets of CIMMYT trials and nurseries planted by collaborators in south Asia (India, Nepal and Bangladesh) during 2012-13 cycle.

BREAD WHEAT 2012-13	33RD ESWYT *1	20TH SAWYT *6	7TH EBWYT	4TH CSISA HT-EM	4TH CSISA-SB	2ND SATYN	1ST WYCYT	TOTAL
TOTAL NURSERIES	9	9	8	10	8	10	10	64
INDIA								
PAU, Ludhiana	1	1	1	1	0	1	1	6
IARI, N. Delhi	1	1	1	1	1	1	1	7
UAS, Dharwad	1	1	1	1	1	2	2	9
IARI, Indore	1	1	1	1	0	1	1	6
UBKV, Coochbehar	0	1	0	0	1	0	0	2
BHU, Varanasi	1	1	0	1	1	1	1	6
DWR, Karnal	1	1	1	1	0	1	1	6
Nepal								
NWRP, Bhairahwa	1	1	1	1	1	1	1	7
Bangladesh								
WRC, Dinajpur/BARI, Gazipur	2	1	2	3	3	2	2	15

Due to CSISA's Objective 4 research, a new wheat variety is now proposed for release: PBW 658 (CS/*Th.sc*//3*PVN/3/MIRLO/BUC/4/ MILAN/5/TILHI) (Figure B11 in Annex B). This variety was approved by the Research Evaluation Committee of PAU, Ludhiana for its release in the state of Punjab. The variety (Figure B11 in Annex B) is currently being grown at farmers' fields at 110 sites in Punjab in adaptive trials for release.

Objective 4 work has resulted in a number of **new wheat lines being promoted to national and state trials** (Table 2) for their evaluation and subsequent release.

Table 2: Number of wheat lines promoted for national, state, station trials or in the IPPSN for evaluation and release

Centre	**National trials**		**State trial**	**Station trials**		**IPPSN**
	AVT	**NIVT**		**Irrigated**	**Rainfed**	
UBKV, Coochbehar			5	6		
PAU, Ludhiana	1	6	32	215	18	16
UAS, Dharwad		3	12	23	20	16

IARI, Indore	1		7	42	18	11
DWR, Karnal	1	3		7	2	17
IARI, Delhi	2	4		24	4	28
BHU, Varanasi	1	2	5	15	3	15
WRC, Dinajpur	3	15	NA	22		5
NWRP, Bhairahwa	5	17	NA	19		21
Total	14	50	61	373	65	129
AVT = Advanced varietal trial; NIVT = National initial varietal trials; IPPSN = Indian plant pathological screening nursery						

More than 1,100 **crosses/backcrosses** (developed by CIMMYT and partners) and segregating populations were exposed to selection in different locations of South Asia and Mexico. These crosses involved heat- and drought-tolerant, spot blotch-, and Ug99-resistant parents. Segregating (F_3/F_4) generations from South Asia dispatched to Kenya for screening against Ug99 resistance. Seventy participatory varietal selection trials were planted in Nepal, India, and Bangladesh; data are under collection. Around a dozen new wheat varieties were tested and seed multiplied at CSISA hubs.

Around 1000 genotypes were planted at the CIMMYT research station Agua Fria in Mexico for evaluation for **molecular markers for wheat resistance to spot blotch**. In addition, around 2000 lines are being evaluated by collaborators in India. Data have been recorded for disease and other traits. Based on multiple years' selections the 4th CSISA-Spot Blotch nursery was developed and distributed across South Asia (Table 1). For mapping work, four populations were planted at four locations of South Asia in crop cycle 2012-13.The four crosses were: i) BABAX/LR42//BABAX/3/ER2000/4/CNO79; ii) SOKOLL//W15.92/WBLL1/3/CNO79; iii) WAXWING*2/CIRCUS//CNO79 and; iv) WHEAR/KRONSTADF2004//CNO79; and the sites were Banaras Hindu University (BHU), Varanasi, Pusa-Bihar, Samastipur, Uttar Banga Krishi Viswavidyalaya (UBKV), Coochbehar, India and Dinajpur, Bangladesh. In addition phenotyping was also done at Agua Fria.

In pursuit of breeding for heat and drought tolerance in wheat, two **manuals** on the use of physiological breeding for were published and widely distributed (Reynolds et al., 2012; Pask et al., 2012). Training was imparted to all collaborators, and infrared thermometers and chlorophyll meters were regularly used by all partners for in-field physiological trait measurement. In the 2012–13 cycle the 1stWYCYT trial having 30 genotypes was grown at 13 locations (Table 1), continuing work from the previous cycle (Pask et al., 2013). Local checks representing the best locally adapted germplasm were included at each site. The recommended sowing and agronomic management was followed to avoid yield limitations. Observations were recorded for different agronomic and physiological traits.

Objective 5: Improved policies and institutions for inclusive agricultural growth

CSISA Objective 5 continues to address the policy environment needed to remove constraints to the adoption of new technologies and enhance the benefits of improved agricultural growth. Objective 5 specifically explores strategies to catalyze durable change at scale through improvements in technology development and delivery, private investment in inputs and services, and public-private partnerships. The two main research areas under Objective 5 are improved policies and incentives that encourage private investment and public–private partnerships in pro-poor technology development and delivery, improved policies and incentives that address changing labor, gender, assets, and migration dynamics related to pro-poor technology development and delivery.

Objective 5 aims to support CSISA's wider goals through several well-defined interventions. First, the objective conducts strategic studies to address constraints and opportunities identified by CSISA's hubs, management, partners, and donors. Second, the objective provides continuous feedback to project planning and priority setting to strengthen CSISA's operations. Third, the objective emphasizes communication of evidence-based recommendations to policymakers and other key stakeholders to effect long-term change in South Asia's cereal systems.

Research continuing from CSISA Phase I includesa study of **market segmentation strategies for new technologies** based on field experiments with laser land leveling in eastern Uttar Pradesh. A series of papers on various aspects of this study will published in mid-2013. These publications will be accompanied by additional outreach materials and activities, including discussions on how to improve technology subsidy targeting and promotion activities. This study is meant to inform CSISA's partnerships with service providers, as well as informing the public policy environment facilitating the adoption of new agricultural technologies.

Also continuing from Phase I is a study on the **impacts of the National Rural Employment Guarantee Act (NREGA) on adoption of resource-conserving technologies**. While NREGA has the potential to provide substantial and reliable income for qualified rural households, it may also affect rural wages, with potential consequences for household labor and migration decisions, intra-household asset allocations, and gender empowerment of landless laborers. This study is meant to inform CSISA's technology promotion activities by providing greater insight into the effects of a large scale public policy intervention on labor, gender and asset dynamics, potentially improving the targeting of resource-conserving technologies.

New research for CSISA Objective 5 began in late 2012 using choice experiments to study **farmers' preferences for abiotic stress tolerance traits** embodied in different rice backgrounds. This study allows for in-depth exploration of demand heterogeneity, and will allow CSISA and its partners to improve strategies for reaching vulnerable farmers who stand to benefit from these traits. The primary component of this study is being conducted in Bihar, with

a companion study in Odisha conducted with collaborators from Jawaharlal Nehru University (JNU).This study is meant to inform CSISA's breeding activities, private sector partnerships, and the public policy environment that enables such collaborations.

Additional research uses field experiments to study **farmers' attitudes toward risk and ambiguity**. These behavioral characteristics are important constraints to technology adoption, since there is often a great deal of uncertainty regarding the benefits of a new technology vis-à-vis conventional technologies. This study is meant to inform CSISA's efforts at promoting technologies by characterizing households who may face these additional constraints to adopting new technologies.

Objective 5 has some *new research under development*, including studies on the substitutive and complementary effects of abiotic stress-tolerance traits in rice and weather index insurance in Bangladesh; the impacts of shocks and vulnerability on input use and management practices in the CSISA countries; rice establishment methods and other crop management practices such as direct seeded rice; policies designed to encourage small-scale mechanization in the CSISA countries, with particular emphasis on Bangladesh and Nepal; and differences in learning patterns among farmers in Bihar, both on an individual basis as well as in social settings.

Objective 6: Project Management, Data Management, Monitoring & Evaluation and Communications

Governance and project management of CSISA in Phase II are designed to (i) enable better linkages with national and regional stakeholders, (ii) simplify reporting and ensure clear lines of accountability, (iii) enable better teamwork and synergy across Objectives and CG partners, (iv) build a more inclusive model for outreach and research that leverages the strengths and addresses the needs of key partners. The section below highlights some of the key activities and advancements achieved under Objective 6 during the reporting period.

Regional Governance: Executive Committee

The CSISA **Executive Committee (EC)** is composed of senior representatives of the CGIAR Centers in South Asia and chaired by the CIMMYT representative. Meetings are held quarterly. The primary roles of the EC include monitoring of project progress and work plan development, approval of fund allocation for regional investments, integration with other activities of the Centers/CGIAR Research Programs in the region, and harmonization of administrative processes and staff policies. The first in-person EC meeting was held on February 9, 2013 in Dhaka, Bangladesh, and was attended by representatives of CIMMYT, IRRI, USAID, and the Bill and Melinda Gates Foundation. The next EC conference call is scheduled for late May, 2013.

Country-level Governance: Management Team

A small **Management Team (MT)** has been composed in India and Bangladesh to lead strategy development, activity planning, and to provide comprehensive technical oversight for the non-breeding objectives of CSISA. The MT is composed of the Country Coordinator (chair) and scientists from each of the CGIAR Centers that lead the activities in Objectives 1, 2 and 5 in that country. Twice a year, comprehensive country-level reviews and planning occur. In India, MT meetings have been held each month since July 2012 and have proven to be a helpful forum for discussing project details and issues, and promoting alignment and communication amongst the partners.

State-level Governance: Advisory and Investment Committees

To reach CSISA development goals and to align the project with government priorities, policies and investments, and to provide new mechanisms for catalyzing partner-driven delivery activities at each hub, CSISA is creating Advisory and Investment Committees (AIC) for Bihar, Odisha, and Bangladesh consisting of NARES leaders and other representatives from the public, private, or civil society sectors. The first inaugural AIC meeting for Bihar was held at the conference hall of ICAR-RCER, Patna on 24 April 2013. The objectives of the meeting were to constitute the AIC for Bihar and to formulate roles, responsibilities and functioning of AIC.

The meeting was chaired by Dr. B.P. Bhatt, Director, ICAR-RCER and attended by AIC members representing various governmental, extension, research, NGO, financial, and private sector partner organizations of CSISA project, such as the Indian Agricultural Research Institute, KVK Jamui, KVK Bhojpur, the International Plant Nutrition Institute, Bihar Rural Livelihoods Project (JEEViKA), Digital Green, National Bank for Agriculture and Rural Development, Rajendra Agricultural University, Bayer Crop Science Ltd., Mashyama Agro Industries, Monsanto India Ltd., and United Phosphorous Ltd.

The Bihar AIC will not only serve as a forum through which diverse stakeholders can seek consensus and alignment on prioritized areas for investment in the state, but will also have funds to allocate to partner-driven activities that are aligned with CSISA's goals[1]. Funds will be allocated on a commissioned and a competitive grants basis. Funds will be managed by the AIC in consultation with the CSISA management team. Five potential areas for investment by the AIC fund were proposed in Bihar, and technical working groups were formed around each topic to take the discussions forward. Areas for investment included: yield maximization, cropping systems optimization for timely wheat planting, yield potential and nutrient management, empowering women in agriculture, and facilitating innovation and entrepreneurship. An AIC has been formulated for Odisha, and the majority of members participated in the 'Building Linkages' dialog that was held in Cuttack at the Central Rice Research Institute (CRRI) on May 10th and 11th. Working group were formulated for post-harvest, nutrient management, rice mechanization, and maize agronomy interventions. These groups have been tasked with

[1] Total funding support to the AIC's during Phase II is $1.2 million USD.

formulating proposals for support from the AIC for Odisha. A reconstituted advisory committee has been composed in Bangladesh, and is scheduled to meet on June 9th. Planning for prior meetings has been disrupted by the strikes and political turmoil that has plagued Bangladesh for several months.

Data Management

CSISA is in the process of upgrading its data management protocols and procedures, and is improving the ways in which data are collected and shared. For example, in India the four partner CG centers in CSISA have employed Surveybe software and portable netbook computers to improve the quality of field-based data collection and to reduce the opportunities for error during data processing. CSISA is also in the process of hiring two data coordinators to lead implementation of best practices for agronomic and M&E data flows. Finally, CSISA is in the final stages of preparing its Phase I baseline survey ready for publishing and distribution through IFPRI's on-line data repository (target date of May 30, 2013).

Communication

CSISA has begun the process of revamping its web site, in compliance with new institutional web site policies and guidelines adopted by CIMMYT world-wide. A new CSISA web site will be launched in the second half of 2013.

To improve communication and document sharing across the CSISA partners and country programs, CSISA has begun using box.com as an online shared document repository. This platform has made it easier to share documents amongst CSISA staff, as well as to maintain an online repository of core program documents, templates, meeting minutes, and datasets, intended to be accessible to the entire CSISA team.

Monitoring and Evaluation

CSISA is in the process of staffing up its M&E team, and streamlining its M&E processes, in line with the semi-annual and annual quantitative and qualitative reporting requirements of our donor agencies. The project has hired an M&E Specialist to coordinate with the donor agencies and implement an overall M&E infrastructure for the initiative, and is in the process of hiring two additional M&E staff members who would be based at the Bihar and Odisha hubs. One of these expected hires has significant MIS/IT experience within the field of M&E, and the other of whom has significant programmatic experience as an M&E officer in India. IRRI has also appointed an M&E Specialist to serve on the CSISA M&E team.

C. Key Challenges Faced, Progress in Addressing Challenges, Plans for the Future

The section below highlights some of the challenges CSISA has faced during the reporting period, with explanation of the strategies used to overcome the challenges specified.

Bangladesh: Impact on implementation of work programs due to 'Hartals' within Bangladesh

Of the 120 possible working days in this reporting period (October 1, 2012 to March 31, 2013) Bangladesh lost 23 days due to Hartals (demonstrations, strikes, and road blocks). Of the days lost, 14 days out of a possible 38 working days were lost in February and March. During Hartals public transport and private vehicles can be attacked with stones and petrol bombs making it dangerous for staff to travel to and from work and for project staff to travel in project vehicles while on work activities. Hartals are normally declared as nationwide activities but they can be confined to specific cities. In the data quoted above only days lost through nationwide Hartals is recorded. During a nationwide Hartal disturbances are not just confined to Dhaka but can occur in any provincial city. This year there have been severe disturbances in the Northwest (Rangpur, Rajshahi, and Bogra) and in the Southeast (Noakhali and Chittagong). There have also been violent disturbances in many of the focal areas on the CSISA-BD project in Southwest Bangladesh (Jessore, Faridpur, Khulna and Barisal).

Despite these hindrances most planned CSISA-BD activities have been completed. This has been due in most to the ingenuity and dedication of the CSISA-BD staff. Our policy has been to ask project staff to only attend work during a Hartal if they thought it was safe to travel and to find ways of completing work cancelled because of a Hartal on another day. In Dhaka most staff are not able to travel into the city during a Hartal. Only those living near the office are able to go to the office and this is normally by foot or rickshaw. For those in provincial centers most offices have used the Hartal day to catch up with office work such as accounts and M&E data entry. In many cases staff have used local transport to work with farmers when crops have been harvested and data has had to be collected on a Hartal day. Although the project management is not encouraging this type of activity it equally acknowledges the dedication staff exhibit when they take these actions. Many staff also use the weekends to catch up with work lost during the week. As a result week days and weekends have become rather blurred.

Nepal

The unstable political situation in Nepal results in frequent 'bandhs' or shut-downs of large swathes of the country—if not the entire country—sometimes for days together. Vehicular movement is blocked and businesses and institutions closed during such times, which makes planning, scheduling, and timely completion of activities and trainings a huge challenge. CSISA-NP has attempted to deal with this, and with the poor road infrastructure by adding two more ARTCs than originally planned, to minimize the need to travel long distances to project sites.

Aside from the bandhs, water is the single largest challenge to intensification in the 16 target districts of Feed the Future Nepal—including Terai districts. Groundwater is a relatively poorly tapped resource in the Terai, and reasonable sources of irrigation in the mid-hills are not common. CSISA-NP is attempting to focus a large amount of mechanization efforts on exploring the potential for axial flow pumps, and increased emphasis on tube wells, in conjunction with

appropriate timing and application of irrigation water (e.g. alternatives to the commonly employed flood irrigation).

Intellectual property rights issues for rice

Because of intellectual property rights issues involved, rice germplasm movement out of India has been heavily restricted in recent years. This issue is being taken up at a high level by various CGIAR institutes in India. For the time being new breeding materials for Bangladesh, Nepal, and Pakistan are being developed at IRRI headquarters. Advanced materials are then being sent to different countries for making selections under specific conditions and for multi-location evaluation.

Institutional Review Board restrictions

IFPRI's Institutional Review Board (IRB) requires that all studies involving human subjects undergo review to ensure the highest ethical standards in the study design and implementation. In 2013, IFPRI's IRB has emphasized local approval of study design, even in countries where capacity for such ethical reviews is limited. This limited capacity in both Bangladesh and India has caused slight delays in study implementation. Similar delays have been experienced by collaborators at JNU, where cited objections were beyond the scope of ethical review. Despite these challenges, continued adherence to IRB requirements will be a hallmark of IFPRI's research agenda, and IFPRI will encourage its partner organizations in CSISA to establish similar mechanisms.

D. Monitoring and Evaluation Activities

In addition to the special evaluative studies briefly described below, a series of estimation techniques have been deployed to assess CSISA's impact during the *Rabi* cropping season, including:

- Characterization of zero-tillage service provider networks coupled with a yield and economic analysis of sub-set of farmers that purchase services.
- Market survey of the availability and sales volume of new classes of herbicides.
- Remote sensing-based evaluation of wheat planting dates in CSISA's focal geographies.

Special Study #1: Direct-seeded rice survey in Bihar and Uttar Pradesh in 2013

During CSISA Phase I, many farmers have been trained on direct seededrice at CSISA hubs and applied DSR on their plots. Despite successful applications of DSR among training participants, adoption rates of DSR remain low among general population. To obtain a better understanding of adoption constraints, we have conducted a survey of DSR users in Eastern Uttar Pradesh and Bihar. From lists of DSR training participant, we have selected 360 training participants and conducted the survey in March and April, 2013.

Although all of the sampled farmers have applied DSR at least once since 2008, only 61% of them have applied DSR in 2012. The main reasons for not applying DSR in 2012 include delayed monsoon (50%), weed problem (23%), drought (12%), service provider not available (11%), and others. The high percentage of farmers who cited delayed monsoon as the main reason for not adopting DSR suggests that farmers may adopt DSR again if monsoon comes as expected this year. Based on recall data of the last four years, we find that the average rice yield under DSR was about 3.6 – 3.8 tons per ha. Regarding labor use, we find that, on average, the total number of labor use was about 60 labor-days per ha on DSR plots, while it was about 103 labor-days on non-DSR plots. Thus, the results clearly indicate that farmers can save labor (mostly in hired female labor for transplanting) by applying DSR. A more thorough analysis is under progress and will be presented to CSISA hub staff and researchers to guide CSISA activities in the future.

Special Study #2: Zero-tillage adoption study (implementation forthcoming)

The agro-ecological and socioeconomic diversity of CSISA hubs was emphasized in the first phase. While there exists some empirical evidence of the incidence of ZT adoption in rice-wheat systems in Punjab, no such assessment exists for Bihar, one of the major focal points of CSISA activities in the second phase. In Bihar, a relatively extensive network of ZT service providers exists (and is currently being characterized with a separate survey), and the technology is probably relatively widely known, making a study which is based on a random sample of ZT adopters and non-adopters feasible. This kind of ground-truthing of the adoption and impacts of one of the major 'CSISA-technologies' at the farm household level is urgently needed in view of a credible quantitative assessment of the impact of CSISA.

If the overall outcome of ZT related CSISA activities was that X farm households are benefiting from using the technology, the proposed study will directly contribute to an intermediate outcome that the benefits of ZT have been soundly established at the farm household level.

Objectives and research questions include the following:

1. Assess farmers' risk exposure, risk preferences, and risk management practices
    - How do CSISA technologies, esp. ZT, fit into this?
    - Are there differences between male and female-headed households (e.g., regarding access to credit and social networks as risk management mechanisms)?
2. Identify influencing factors of ZT adoption, including influencing factors of the *scale* of adoption
    - Do ZT adopters use the technology on all their plots / only the largest plots / only the most or the least fertile plots? Which criteria do they use to decide at what scale to apply ZT?

- Thoroughly assess adoption determinants, with special emphasis on risk and technology preferences, social capital, and access to formal and informal credit.
- Assessment of technology adoption could be expanded to ZT *cum* DSR, i.e., a true conservation agriculture practice

3. Estimate the impact of ZT adoption on farm households' income / expenditures / food security status

- This includes a thorough assessment of how farmers utilize the time saved by adopting ZT.
- Multiplying the quantified average welfare impact with the number of clients of service providers trained through CSISA and its partners would give us an estimate of the ZT related impact of CSISA on farm households' welfare (prerequisite: impact assessment must be based on comparable groups of adopters and non-adopters, see below).

E. Major New Initiatives for Next Half-year

Objective 1 and 2

New CSISA initiative in Bangladesh: 'CSISA-M.I.'

CSISA has recently been awarded a new five-year, $12.5 million award by the Feed the Future program of the USAID Mission in Bangladesh, entitled *Feeding the Future through Sustainable Intensification: Transforming Southern Bangladesh through Surface Water Irrigation, Efficient Agricultural Machinery, and Local Service Provision*. This award will be run as a sub-initiative of the larger CSISA project, will be led by CIMMYT which will partner with International Development Enterprises, and is expected to begin operations in mid-2013.

The working title for the project is CSISA Mechanization and Irrigation (CSISA-M.I.). CSISA-M.I.aims to transform agriculture in Southern Bangladesh by unlocking the potential productivity of the region's farmers during the dry season. Currently, only 50% of the 13 million farming households in Southern Bangladesh produce a dry season crop. To produce more food from the same parcel of land while minimizing environmental externalities and optimizing agro-ecosystem functioning—the essence of sustainable intensification—the project will undertake the following interventions to forgo dry season fallows:

Broad access to low-cost surface water irrigation in the dry season: The game changing technology proposed here is the introduction and commercialization of the axial flow pump which can overcome the price bottlenecks for irrigation by saving farmers up to 46% in diesel

costs over conventional pump sets in low lift environments where surface waters are the source. But irrigation technology is not sufficient for sustainable change. As such, CSISA-M.I. endeavors to build lasting equipment supply chains and work with irrigation providers to develop smart business models to provide irrigation at low cost to farmers at scale.

Commercialization of essential agricultural machineries and associated services: CSISA aims to optimize water, labor, time, seed and fertilizer—all critical resources that farmers must conserve to assure sustained crop productivity—by building public and private sector capacities through partnerships with Government of Bangladesh institutions engaged in irrigation, agricultural mechanization, and extension, as well as with agro-dealers, and with small- and medium-sized machinery manufacturers. This project will also play a catalytic role to bring the gap between the public and private sectors in Bangladesh.

Cumulatively, the interventions that comprise these objective outputs will result in 90,000 ha of land placed under surface water irrigation and/or best-bet, resource conserving agricultural machinery services supplied by 11,000 LSPs. 490,000 households will benefit from these activities. $12 million of private sector investment will be mobilized to support these aims. To assure the long-term durability of these interventions, the project will strategically boost the capacities of Government of Bangladesh and private sector partners, and develop networks of scale-appropriate agricultural machinery service providers appropriately trained using hands-on, experiential learning approaches to assure performance quality – and benefits for farmers – in the field.

India: New research trials to be conducted at the research platforms and in farmers' fields

The following new experiments will be conducted to address emerging issues and close key knowledge gaps:

Weedy/volunteer rice management in dry seeded rice. Weedy or volunteer rice is an emerging problem in dry seeded rice. Weedy rice is difficult to control and no selective herbicides are available to control it. Therefore, the effects of stale seedbed, the inclusion of mungbean in the fallow period between wheat harvest and planting of rice and tillage will be studied on weedy rice. This study will be conducted at farmers' fields in Haryana and eastern UP hubs.

Accessing the role of swarna sub-1 in mitigating seedling mortality losses due to early inundation in DSR. In DSR, sudden rain during the early establishment stage can adversely affect crop establishment. Therefore, a study will be conducted to see whether the sub-1 gene can help in mitigating this risk in DSR. This study will be conducted at a research station.

Evaluating varietal performance under DSR. Very few breeding efforts have been made in the breeding of rice varieties suited to DSR conditions. Therefore, it is important to identify from the currently released hybrids or inbred for transplanted conditions which also perform better under DSR. This will be done in Haryana, eastern UP, Bihar and Odisha.

Evaluating the performance of maize hybrids on raised beds during the Kharif season and their capacity to facilitate area expansion in Kharif maize. Very little information is available on the performance of maize hybrids during the Kharif season. Therefore, to identify best performing hybrids on raised beds, this study will be conducted at farmer's fields in Haryana, Eastern UP, Bihar, and Odisha.

Assessing the effects of introducing maize as an alternative to rice in rice–wheat systems of northwest India on secondary salinization. A significant area under rice in northwest India is grown in reclaimed, salt-affected soil. Rice, in addition to chemical amendments, has played a major role in reclaiming these soils because rice cultivation resulted in leaching out salts. Recently, water and labor scarcity in the region have created increased interest in diversifying rice with maize. It is important to understand what would happen to the salt movement with the introduction of maize in place of rice in the short to medium term, and what role conservation agriculture can play in addressing some of the issues of salt movement when rice is replaced by upland crop like maize. This study will be conducted in collaboration with CSSRI at their station.

Cropping system optimization through intensification and diversification. To address the emerging issues and to adapt to drivers of agricultural change (rising labor, water, and energy scarcity, degrading soil health/natural resources, rising production costs, and climate variability), there is a need for highly productive, resource-efficient, and sustainable crop rotations and management practices that are adapted to the expected changes in socioeconomic and environmental conditions. This will require further intensification and diversification while increasing resource use efficiency and reducing the environmental footprint. Some model farmers will be identified to optimize rice–wheat and maize–wheat cropping systems.

Nepal: Priorities for the first spring and summer seasons

Spring maize (Terai): CSISA-NP will focus on conducting a grain/stover yield assessment and a cost: benefit analysis with farmers at crop maturity. We will also facilitate exposure visits at maturity by farmers from surrounding areas, to rank and discuss their preferences in the presence of DADOs, NARC scientists, seed company representatives, and project staff. These preferences will include yield as well as other indicators (taste, smell, appearance/texture, milling/processing ability etc.)

Rice (mid-hills and Terai): CSISA-NP will conduct a variety of trials, including baby trials on Informal Research and Development (IRD) seed sets implemented primarily by Agriculture Service Centers (ASCs) of the DADOs to assess performance of farmer and newer rice varieties/hybrids, and popularize newer, high-performing varieties. We will also undertake management trials to determine yields and economic returns from direct seeded rice vs. transplanted rice, and recommended vs. farmer nutrient management on farmer varieties and newer varieties and hybrids. Further, diagnostic trials will determine the cause of poor grain fill

problems articulated frequently by mid-hill communities in Dadeldhura and Achham districts. Omission plots in multiple locations will be undertaken to determine indigenous nutrient supplying capacity of soils and generate data for Nutrient Manager algorithms. Finally, we will conduct machinery demonstrations on the 2-wheel tractor + seed drill and 4-wheel tractor + seed drill for DSR in Terai domains; 3-4HP mini-tiller + rolling jab planter in mid-hills; and the mini-combine harvester at harvest.

*Summer maize (mid-hills):*Baby trials will be implemented primarily by ASCs to assess performance of farmer and newer maize open pollinated varieties (OPVs)/hybrids. Management trials will determine the effect of improved seed establishment and nutrient management on farmer varieties and newer varieties and hybrids. Omission plots in multiple locations will be undertaken to determine indigenous nutrient supplying capacity of soils and generate data for Nutrient Manager algorithms. Machinery demonstrations will be conducted on 3-4HP mini-tiller + rolling jab planter in mid-hills, and conservation agriculture demonstrations will be conducted on maize strip-seeded into plots with 25-50% wheat residue retained in field vs. conventional seeding with no residue retention.

Other/cross-cutting: Multi-stakeholder trainings will be held on business plan development; cost-benefit calculations; machinery trainings and demos, including safe use; and integrated nutrient management and better bet crop management in rice, lentil, and maize. A market assessment of machinery sector and value chain in mid and far-western Nepal will be conducted. Also, videos will be produced on DSR, including when, where, and why farmers practice it (3-5 min modules). TV and radio spots will be produced on integrated nutrient management, and improved management for rice, lentil, and maize. Discussions initiated in February 2013 will continue on utilizing a micro-credit enterprise designed primarily to serve the financial needs of poor rural women (Mahila Sahayatra Micro Finance Bittiya Sanstha) to catalyze relationships between farmers andmicro-credit, as target districts do not have many possibilities for farmers to avail themselves of loans.

Objective 3: Rice breeding

In the search for elite rice lines with increased yield potential, improved grain quality and superior feeding value, more than 300 new breeding lines will be evaluated in observational yield trial. CSISA will conduct physiological trait-based selection on diverse germplasm and elite lines for high yield potential (HYP) using high-throughput phenotyping platform. We will also design SNP assays and genotype for cloned yield-related genes/QTLs; initiate a breeding program for HYP. Single plant selections for desirable plant types suitable for transplanted condition will be carried out in 20 F2,10 BC1F2 and 15 BC2 F2 populations. Promising selections from F3,F4, F5 and BC1F3,BC1F4 and BC2F3 and BC2 F4 will be advanced to next generations. In collaboration with NARES partners, the work on straw quality will be intensified from wet season 2013 onwards. The work on developing mapping populations for straw quality

will be initiated. Finally, we will initiate a new population improvement program for enhancing genetic gain through recurrent selection.

In order to develop rice for mechanized direct seeding and water-saving irrigation practices, CSISA will provide an off season nursery facility for advancement of breeding material will be provided to North Indian centers. Also, an RGA facility for quick development of fixed lines will be established. We will continue to conduct a multi-location evaluation of hybrids, varieties and new breeding lines under machine sown dry direct seeded conditions in India, Nepal and Bangladesh during the wet season of 2013. More than90 entries including hybrids will be evaluated. Genotyping work in the two mapping populations for early stage seedling vigor will be continued and advancement of generation to develop NILs and BILS will be taken up. More than 350 new breeding lines will be evaluated in observational yield trial. Single plant selections for desirable plant types suitable for dry DSR will be carried out in 50 F2, 12 BC1F2 and 10 BC2 F2 populations. Promising selections from F3, F4, F5 and BC1F3, BC1F4 and BC2F3 and BC2 F4 will be advanced to next generations.

In order to develop high-yielding, heat-tolerant rice, NILs ofqHTSF4.1 (BC_5F_2) in IR64 background will be evaluated by end of 2013.Further fine mapping of the QTL on chromosome 4 and 1 will be conducted in order to reconfirm their impact towards reducing heat-induced spikelet sterility. CSISA will validate developed molecular markers for these two fine mapped regions, and will identify additional donors for early morning flowering and new mapping populations will be developed for high night temperature tolerance. We will quantify the respiratory losses due to high night temperature under field conditions, and finally, will phenotype more than 300 new breeding lines for reproductive stage heat tolerance at three locations in India.

Objective 4: Wheat breeding

CSISA will collect data, and will evaluate and characterize new wheat lines for grain yield under diverse environments and varieties, and will identify suitable lines for national, state, and station trials for release. We will also advance the segregation of populations at various breeding sites after completing the selection, identify spot blotch resistant varieties, disseminate seed of outstanding lines to hubs, and will analyze physiological traits.

Objective 5: Policy research

Work will continue with studies examining farmers' preferences for abiotic stress tolerance in rice.Data collection in Bihar began during April 2013 and will continue through May 2013, while data collection in Odisha will begin in May 2013 and continue into June 2013. Preliminary results from Bihar will be presented in mid-2013. IFPRI will also continue work on a study examining risk and ambiguity preferences. Data collection began in April 2013 and will continue through May 2013.Preliminary results from this study will be presented at the AAEA annual meeting in August 2013. Finally, work will begin on a study using field experiments to

determine heterogeneity in learning heuristics. This study will provide valuable information regarding the different ways in which individuals process information from past experiences and use this information to modify expectations regarding, e.g., the benefits of a new technology, weather, etc.

II. Annex

Annex A: Results Framework

CSISA PHASE II: RESULTS FRAMEWORK – KEY MILESTONES

Key Milestones		Period One		Progress Narrative - May 2013
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 1. Widespread dissemination of production and postharvest technologies to increase cereal production, resource efficiency, and income				
Sub-objective 1.1. Implementation of a goal-oriented road map for transitioning existing hubs in Punjab, Haryana, Tamil Nadu, and Pakistan, and modalities for operationalizing new hubs in E. UP, Bihar, and Odisha				
1.1.1.1. Road map for transitioning existing hubs in Punjab, Haryana, Tamil Nadu, and Pakistan implemented.		Strategy to transition hubs while contining to ensure impact of CSISA investments is developed and initiated.		Transitions to other aligned projects completed in Nepal and Pakistan. Exit strategies defined for Haryana, Tamil Nadu, and Punjab.

1.1.2.1. Primary impact pathways for each hub domain defined to provide a goal-oriented road map that combines innovation, product development, and strategic partnerships.		In consultation with core partners, primary impact pathways defined and prioritized for action in order to accelerate the out-scalling of key CSISA-supported technologies.		Impact logic mainstreamed into activities planning at twice-annual evaluation and planning meeting held a the coutry level in Bangladesh and India (started in Bangladesh in 2011). Concepts and implementation mainstreamed with the India hubs in January 2013.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 1. Widespread dissemination of production and postharvest technologies to increase cereal production, resource efficiency, and income				
Sub-objective 1.2. Participatory technology testing and adaptation for sustainable intensification				
1.2.1.1. Production and livestock feed technologies that address key knowledge gaps and specifically address the needs of women.		At least 10 adaptive research trials addressing prioritized knowledge gaps conceived and implemented in each hub, including 6 that meet women's needs during the principal growing seasons.		Pilot trials initiated with new partner organisations in Odisha, existing partner organisations expanding trial activities to new areas in Bihar and Nepal, trial activities integrated into hub activities in Rangpur/Bangladesh

1.2.2.1. Prioritized production and livestock feed technologies that have been tested and improved in the context of communities to match the needs of different regions, farmer groups, and women.		At least 25 participatory technology verification trials or demonstrations, and animal feed development groups active in at least 4 hubs, with innovative feed strategies defined and tested during principal growing seasons.	Partners in Bihar and Nepal have added further groups to their activity networks; new partner (dairy) organisations in Odisha will target their existing milk supplier networks; village activity networks are currently being expanded in Rangpur/Bangladesh
		Partial budget analyses of three key technology interventions conducted in each hub.	Completed as planned.
1.2.4.1. Strategies to overcome principal gender-differentiated causes of postharvest cereal losses in each hub domain.		Gender-differenentiated extent and prime causes of postharvest losses determined with men and women in at least four hubs.	PRA and key informant interviews completed in Bangladesh, Bihar, and Odihsa to characterize PH losses and key intervention points.
1.2.5.1. Strategies to overcome biophysical, socioeconomic, and policy-related constraints to farmer adoption of key production, livestock feed, and postharvest technologies.		Constraints to the acceptance of key technologies documented in at least four hubs, and stratgies to overcome these identified.	PRA and key informant interviews completed in Bangladesh, Bihar, and Odihsa to characterize PH losses and key intervention points.

Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		

Objective 1. Widespread dissemination of production and postharvest technologies to increase cereal production, resource efficiency, and income			
Sub-objective 1.3. Translating research into actionable products and insights.			
1.3.1.1. Web and mobile-phone based applications to aid decision-making by men and women farmers at large scale but with context-specific information, including site-specific nutrient management for different crops, cropping systems, and regions.		Requirements and interest of men and women farmers for real-time and site-specific information on agronomic best practices assessed within the context of technical feasibility along with ex-ante and ex-post evaluations.	Action deferred until Crop Manager beta version is released in India (beta version for rice will be used in the forthcoming kharif).
		Nutrient management software validated for different crops, cropping systems, and regions (Web and mobile-phone applications), and Crop Manager application designed based on user requirements.	Beta versions of rice and maize tools released in Bangladesh; rice tool release planned in Tamil Nadu.
1.3.2.1. Strengthened and diversified dissemination pathways for agricultural knowledge and technologies using traditional approaches and ICTs.		At least 6000 farmers and partners exposed to new technologies through community-based demonstrations, trainings, and at least 10 cross-hub exposure visits.	Targets exceeded.
		Instructional videos developed and deployed to more than 250 villages; uptake following exposure to videos assessed.	Targets exceeded.

		User assessment performed, and CKB design/content plan refined based on assessment; at least 10 new entries incorporated, and at least 10 hub staff and partners in each hub introduced to/updated on CKB.	CSISA calender for 2013 produced and distributed. Reprints of other useful material being ordered. Knowledge mapping exercises for Odisha initiated and completed for one district in Odisha. Partnership mapping exercises for content development and dissemination completed for Odisha, planned for Bihar. Pilot for video content production with Digital Green initiated in Odisha, ongoing in Bihar. 1 video produced in Bihar, 5 planned for Bihar and 10 for Odisha
1.3.4.1. Identify and facilitate dissemination of superior dual-purpose rice, wheat, and maize breeding lines and hybrids in South Asia through breeding networks, farmers, and fodder traders.		Released or near-release rice, wheat, and maize lines/ hybrids with superior 'dual purpose' traits identified, characterized, and matched to prioritized production ecologies.	Progressing as planned.
		At least 30 promising rice lines/hybrids in multi-location replicated yield trials evaluated for straw fodder traits.	Progressing as planned.
		Promising heat and disease-resistant maize cultivars tested in hub domains with partners, including breeders from national programs.	Progressing as planned.

1.3.5.1. Business models targeting men and women entrepreneurs for sustaining change through private enterprise and investment.		Gender-based and other constraints to the initiation of agricultural businesses evaluated, and at least 5 business models developed or strengthened that incorporate technologies recommended by CSISA.		Progressing as planned.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 1. Widespread dissemination of production and postharvest technologies to increase cereal production, resource efficiency, and income				
Sub-objective 1.4. Mobilizing partnerships for catalyzing impact at scale.				
1.4.1.1. Advisory committees and partnerships to help define research and development directions, link other players to hub activities, and promote CSISA technologies and out-scaling methodologies.		Technical Working Groups (TWGs), Advisory + Investment Committees (AIC) constituted; meetings held in each hub.	TWG, AIC meetings held in each hub to revise workplans in light of learning and new partnership opportunities.	Advisory and Investment Meeting held in Bihar and Odisha; Bangladesh scheduled for June 9th. TWG concept has been revisited, and consistuted as on-going interactions with specific partners for specific technical themes rather than a general standing committee.

		At least 5 major partnerships established or strengthened each year in the priority hubs with support from the TWG/AIC.		Targets exceeded with a strong mix of public (e.g. JEEViKA, State Departments in India), private (e.g. RFL in Bangladesh), and NGO (e.g. Digital Green in Odisha) partners. Crucially, we are also catalyzing parterships among our core partners.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 1. Widespread dissemination of production and postharvest technologies to increase cereal production, resource efficiency, and income				
Sub-objective 1.5. Strategic capacity development to support key agents of change.				
1.5.1.1. Capacity development for men and women CSISA staff and public and private sector partners/actors to play leading roles in accelerating impacts at scale for farmers.		'Training of trainers' (ToT) course for senior and junior CSISA hub staff and selected partners, including social and gender issues developed and conducted.		Initial focus has been on increasing the technical competencies of new staff. ToT has been reframed as a second-order priority.

		Leadership course conducted for at least 20 women engaged in agricultureal research, development, and extension.	Activity has been re-oriented to target women entrepreneurs. Course is now under development and will be deployed in Bihar by Q3 of 2013 with NABARD and JEEViKA as partners.
		Training course with modules covering at least 5 animal husbandry topics prepared and conducted for staff and partners at prioritized hubs.	Efforts to harmonise and document current training activities are on-going. Links between farmer groups and existing training institutions are being developed.
		Demand-driven trainings developed and conducted for at least 300 local service providers to improve mechanized, better-bet agronomy and business development skills for new and existing entrepreneurs.	Targeted exceed. BDS aspect in the process of being strengthened.
		Dealer training programs and certification examinations designed, agronomy extension leadership program piloted in two hubs, and program requirements and business plan developed.	Dealer training program launched in Bihar. Decision on certification still pending partner feedback.
1.5.3.1. Next generation of cereal systems scientists and development professionals, especially women, strenghtened.			Student recruitment on-going.

		Training modules developed and short-term advanced courses conducted for hub staff (including animal husbandry) and at least 75 young male and female scientists.		Test modules completed for DSR for evaluation in Kharif 2013.
		At least 30 interns (30% female) placed in CSISA hubs and partner institutions.		Intern recruitment process proceding.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 2. Crop and resource management practices for future cereal-based systems.				
2.1.1. Optimized cereal-based cropping systems based on performance assessments of new and current technologies that are optimized for productivity, resource efficiency, and GWP.		Four research platforms established, strengthened, or continued with new and on-going experiments that address key oppportunities to optimize sustainability and profitability based on feedback from farmers and hub-based socio-economics and biophysical scientists.		New and on-going experiments conducted in Bihar, Bangladesh, and Haryana. Platform activities in TN continued through March 2013.

		In collaboration with NARES partners, identify and communicate constraints associated with CA-based systems and develop hypotheses to inform process-based research trials that will lead toward system refinements.		New experiments devised in Haryana, Bihar, Tamil Nadu, and Bangladesh on topics such as managing secondary salinization with CA and precision water management under crop diversification scenarios.
2.2.1. Models for assessing cropping system performance under different agro-ecological conditions and climate-change scenarios.		Evaluate and improve modeling tools such as APSIM, DSSAT, ORYZA 2000, and DNDC		CSISA has joined the AgMIP (model intercomparison and improvement) initiative and is working with the APSIM, DSSAT, and TOA-D development teams to assess and improve simulation performance at locations across the IGP.
2.3.1 Platform trials are adjusted to incorporate key knowledge gaps identified from on-farm adaptive research and technology verification trials. New insights developed at the platforms informs the design of on-farm trials for multi-locational testing.		Joint planning and evaluation meetings held between Objective 2 and Objective 1 teams twice a year.		Objective 2 meeting held in October 2012. Integrated planning with Objective 1 conducted in Haryana and Bihar; pending in Bangladesh.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 3. High-yielding, heat- and water-stress-tolerant rice varieties for current and future cereal and mixed crop-livestock systems.				

3.1.1. Next generation of elite rice lines with increased yield potential, improved grain quality, and superior feeding value, heat tolerance released.		Selected breeding lines evaluated through public- and private-sector breeding network, dissemination of superior dual-purpose breeding lines and hybrids facilitated through breeding networks, farmers, and fodder traders.		Fifty breeding lines were evaluated in multilocation trials conducted during the wet season 2012. Six promising lines along with 60 new breeding lines will be evaluated in MET during Kharif season 2013.
3.2.1. Rice for mechanized direct seeding and water-saving irrigation practices developed and released.		At least 25 new lines/hybrids in different maturity groups tested under mechanized DSR and CA at 4-6 locations; at least 10 new hybrids/breeding lines entered in national varietal testing programs.		Ninety entries involving breeding lines and hybrids were evaluated in MET conducted during wet season 2012.Nine promising entries were identified for second year of testing in 2013.
3.3.1. At least two heat-tolerant rice varieties nominated for national varietal testing.		Reliable field phenotyping facilities and protocols established in CSISA hubs;		Established field phenotyping facilities and protocols for heat tolerance/avoidance in CSISA hubs across hot-dry (Hyderabad and Ludhiana in India) and hot-humid (Tamil Nadu in India and Joydebpur in Bangladesh) regions
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		

Objective 4. High-yielding, heat- and water-stress tolerant, and disease-resistant wheat varieties for current and future cereal and mixed crop-livestock systems.				
4.1.1. Improved early, mediium, and normal-maturing bread wheat varieties for heat- and water-stressed environments.		30 lines each of early, medium, and normal-maturing HYP wheat that is heat, drought, and disease-tolerant tested; at least 200 segregating breeding populations selected; new crosses made at CIMMYT and by NARES; 5 best lines evaluated in multilocation yield trials.		Achieved as planned, including 64 different bread wheat nursuries planted across South Asia in 2012-13.
4.2.1. Spot blotch-resistant wheat germplasm and molecular markers for resistance to the disease.		Resistance to spot blotch characterized through annual screening in Mexico and hot-spots in South Asia; capacity of spot blotch screening in Mexico and hot spots of S. Asia enhanced.		Around 1000 genotypes planted at Agua Fria (Mexico) for evaluation. In addition, around 2000 lines are being evaluated by collaborators in India.
4.3.1. Improved heat and drought tolerance in wheat.		Physiological and environmental limitations to yield established; conceptual models for heat- and drought-adaptive traits refined to increase yield potential; phenotyping manual developed and trainings conducted for hub staff and partners.		Progress as planned.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		

Objective 5. Improved policies and institutions for inclusive agricultural growth				
5.1.1. Improved policies and incentives that encourage private investment and public-private partnerships in pro-poor technology development and delivery.		Concrete strategies developed to: a) acheive the policy changes required for improved delivery of seeds and other inputs b) unite public and private partners in delivery of CSISA technologies, including specification of appropriate incentives for market segmentation and implementable agreements for Public/Private Partnerships.		Strategies under development, in publication, and under discussion; continuing communications efforts planned to bring public and private partners together.
5.2.1. Improved policies and incentives that address changing labor, gender, assets, and migration dynamics related to pro-poor technology development and delivery.		a) Study methodology developed to assess gender-differentiated access to and control of key assets, the role of women in agricultural technology adoption decisions, and the role of rural employment schemes on adoption of resource-conserving technologies.		Efforts still ongoing: Specific study objectives and methodologies under deveopment.
Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		

Objective 6. Project management, data management, communication, evaluation, and decision support.			
Sub-objective 6.1. Project management			
6.1.1.1. Effective and efficient project management.		Hold monthly and quarterly meetings with CSISA objective leaders and institutional partners; biannual meetings with advisory and investment committees, annual forum with key NARES representatives from across S. Asia.	Country-based 'MT' and project-wide 'EC' meeting conducted as planned. Regional forum scheduled for Fall 2013 following the ICAR-supported and USAID-sponsored meeting on heat tolerance.

Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		
Objective 6. Project management, data management, communication, evaluation, and decision support.				
Sub-objective 6.2. Data management and communication				

6.2.1.1. Standardized data collection across project, minimum data set characterized by consistent metadata schema for ease of reuse, data easily retrievable, mined across project.		SOPs for data collection optimized and data training held, agronomy module designed for Integrated Breeding Platform (IBP), AgTrials, DataVerse customized, Surveybe, OpenDataKit operational, Google Fusion implemented for analysis, visualization, mapping. Minimium meta-data requirements implimented by 12/2012 by CSISA-funded partners.	Data standardization protocols partially completed across the project; good progress on developing data portals with strong meta-data standards and open public access (e.g. AgTrials and ORNL collaboration for geo-spatial data)
6.2.1.2 Key CSISA datasets made widely available through public access data repositories.		Regionally and globally important datasets from Phase I of CSISA (i.e. strategic research, socioeconomic studies, and multi-location screening trials) are made publically available in well-documented formats.	Data from experimental platforms uploaded into AgTrials. CSISA HH survey baseline data scheduled for public release by May 17th, 2013.
6.2.2.1 Improved communication across project personnel and locations, shared learning, record of project, and accountability, improved PR and dissemination of information about CSISA.		CSISA Wiki/group communication platform created; project personnel and hub staff trained to add project documents and materials; CSISA Web site created, tested, refined, and frequently updated.	Progress, with launch of new website planned for Q3 2013. Internal communications platform established and functional.

Key Milestones		**Period One**		
		October 2012	*May 2013*	
	Baseline *(if relevant and available)*	**Target at period end**		

Objective 6. Project management, data management, communication, evaluation, and decision support.			
Sub-objective 6.3. Project evaluation of outcomes and impacts			
6.3.1.1. Comprehensive assessment and continual refinement of project processes, outcomes, and impacts, with lessons learned incorporated and communicated to partners, donors, and stakeholders.		Implement M&E system, collect and upload disaggregated (by hub, gender) data for outputs that are tied to intermediate outcomes	New infererence techniques devised and implemented to assess progress towards intermediate outcomes for Rabi 2012-13. Techniques have been customized and matched to different project interventions.

Annex B: Photos

Figure B1. CSISA team meeting with women's self-help groups in Mayurbanj, Odisha in April 2013, to talk about winter fallows

FigureB2.A Bansgadi, Bardiya villager practices her skills with the powered sickle or brush cutter as part of a CSISA-NP training demonstration

Figure B3. HiraLalTharu of Kakaura Village in Deudakala VDC, Banke using his 2WT and CSISA-NP reaper for harvesting his wheat as part of a CSISA-NP training demonstration.

Figure B4.A new mini tiller attachment—a powered open-drum thresher—being tested with wheat in Bansgadi, Bardiya district. There were mixed reviews by onlookers, but this technology has been used for years by farmers in Kathmandu valley for both wheat and rice.

Figure B5. Startup page of the *Nutrient Manager for Rice for Tamil Nadu* in the local language

Figure B6. ‘Running on empty’ – Water crisis in Tamil Nadu, tributary of the Cauvery River near Thanjavur in December 2012.

Figure B7. Flatbed dryer for Bangladesh

Figure B8: Establishment of zero-till dry-seeded rice in full mungbean and previous wheat stubbles (A) and zero-till wheat in full rice residue (B) at CSISA Karnal Research Platform, CSSRI, Karnal.

Figure B9. (a) Establishing fully automated weather stations including soil moisture meters and Apogee hand held infrared thermometers in TNAU, Coimbatore, Barwale foundation in Hyderabad and PAU. Similar station will be established in a hot spot location in Bangladesh in 2013

Figure B10. Rapid MABC system is under development by arranging donor/recipient plants side-by-side

FigureB11. PBW 658, a new wheat variety proposed for release in the state of Punjab

Annex C: Publications and important links

Links from Objective 1: Presentations from Mechanization workshop in Bangladesh

Rural Mechanization: Status and Issues in Bangladesh, M. A. SattarMandalhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/RuralMechanization_StatusIssuesBangladesh_SattarMandal.pdf

The Status of Agricultural Machinery Manufacturing in Bangladesh, Md. MonjurulAlamhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Agri-machineryBangladesh-Monjurul%20Alam.pdf

The Status of Farm Mechanization in West Bengal, Dr. VK Tiwarihttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Farm%20MechanizationWestBengal_VKTiwari.pdf

Gender Dimensions of Labour Supply, Employment Dynamics of Wage Labour and Out Migration: Implications for Farm Mechanization, WMH Jaimhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/GenderWageLaborEmploymentOutmigrationDynamicsinFarmlMechanization_Jaim.pdf

Farm Mechanization in Bangladesh: Evidence from IFPRI National Household Survey,Akhter Ahmed http://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/IFPRISurveysEvidenceofMEchanizationininBangladeshAkhterAhmed.pdf

Nature and Impact of Agricultural Mechanization in Bangladesh: Insights from Farm Level Surveys MahabubHossain, MahfuzRahman, Sudhir. C. Nath, AlamgirChowdhuryhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/NatureImpactMechanizationinBangladeshocalLevelSurveys_MahabubHossain_RahmanNathChowdhury.pdf

Review of Research and Extension in Farm Power Issues Project*: Findings and Impacts* Professor Dr. R.I.Sarker Gerard Hendriksenhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/ResearchExtensionFarmPowerIssues_SarkerHendriksen.pdf

Productivity and Efficiency of Rice Milling System in Bangladesh M. Asaduzzamanhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Rice%20Milling_Presentation_Asaduzzaman.pdf

Solar Energy in Rural Mechanization, NazmunNaharhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Rural%20Mechanization%20by%20Solar%20PV%20Nazmun%20Nahar.pdf

Rural Mechanization in Nepal: Technological Options and Policy Issues,D. Gauchanhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Rural-Mechanization-NepalDGauchan.pdf

Commercialization of Selected Agriculture Machineries – Study Findings, R. Pradhanhttp://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/Study_CommercializationofSelectAgriMachineryMarketSurveyPradan_et_al.pdf

Rural Mechanization: A history of the spread of smaller scale technology in some Asian countries, S. Biggs and S. Justice http://dl.dropbox.com/u/101834755/BanglaMechWS_PPT/HistorySpreadofMechanizationinSomeAsianCountries_BiggsJustice.pdf

Publications emerging from Objective 2: Publishing CSISA Phase I strategic research results

From the CSSRI Karnal Research Platform, a paper entitled 'Optimizing Intensive Cereal-Based Cropping Systems Addressing Current and Future Drivers of Agricultural Change in the Northwestern Indo-Gangetic Plains of India' has been accepted with minor revision for publication in a special issue of *Agriculture Ecosystem and Environment*, a journal on conservation agriculture. The revised draft submission date is due on May 25, 2013. After publication, all of the raw data will be uploaded on the AgTrials website. Presently, scientists at the Karnal platform are working on a second paper which will focus on soil parameters and energy data.

From the ICAR-RCER Patna Research Platform, a draft of the first paper is ready for submission to *Field Crops Research*, a journal covering yield, water use and productivity, energy use, and economics.

Scientists at the research platforms at Aduthurai, Tamil Nadu and Gazipur, Bangladesh: Decided to write their research paper after finishing three cropping cycles because of inconsistent results of first two cropping cycles.

Objective 4 publications

Chand R., O.P. Yadav, B. M. Bashyal, L.C. Prasad and A. K. Joshi (2013) Technique for the maintenance of heterokayotic isolates of *Bipolarissorokiniana* under ordinary conditions. Indian Phytopath. 66 (1) : 61-65

Kumari M, R.N. Pudake, V.P. Singh, and Arun K. Joshi (2012) Association of staygreen trait with canopy temperature depression and yield traits under terminal heat stress in wheat *(Triticumaestivum* L.). Euphytica(DOI 10.1007/s10681-012-0780-3)

Paliwal R., B. Arun, J.P. Srivastava and Arun K Joshi (2013) Inheritance of terminal heat tolerance in two spring wheat crosses. Cereal Research Communications (In press)

M. Eisa, R. Chand, A.K. Joshi(2013) Biochemical and histochemical factors associated with slow blighting to spot blotch in wheat. Lithuanian journal of agriculture (In press)

Pask, A.J.D., J. Pietragalla, D. Mullan, and M.P. Reynolds (Eds) (2012) Physiological Breeding II: A Field Guide to Wheat Phenotyping. CIMMYT, Mexico D.F.

Reynolds, M.P., A.J.D. Pask, and D. Mullan (Eds) (2012) Physiological Breeding I: Interdisciplinary Approaches to Improve Crop Adaptation. CIMMYT, Mexico D.F.

Pask, A.J.D., M.P. Reynolds, I. Sharma, R. Chatrath, G.P. Singh, V.S. Sohu, G.S. Mavi, V.S.P. Sukaru, I.K. Kalappanavar, V.K. Mishra, A. Balasubramaniam, Y. Mujahid, M. Hussain, N.R. Guatam, N.C.D. Barma, A. Hakim, A.K. Joshi (2013). The CSISA wheat phenotyping network.*In* Reynolds M, Braun H, (Eds.).Proceedings of the 3rd

International Workshop of the Wheat Yield Consortium. CENEB, CIMMYT, Cd. Obregón, Sonora, Mexico, 5-7 March 2013. Mexico, DF.: CIMMYT.

Objective 5 publications

Discussion/working papers

Nazli, H., S.H. Haider, and A. Tariq. 2012. *Supply and Demand for Cereals in Pakistan: 2010-2030.*IFPRI Discussion Paper 1222. Washington, DC: International Food Policy Research.

Salam, A. 2012.*Review of Input and Output Policies for Cereals Production in Pakistan.*IFPRI Discussion Paper 1223. Washington, DC: International Food Policy Research.

Spielman, D.J., D. Kolady, P. Ward, H. Ar-Rashid, and K. Gulati. 2012. *Public Expenditures, Private Incentives, and Technology Adoption: The Economics of Hybrid Rice in South Asia.* IFPRI Discussion Paper 1233. Washington, DC: IFPRI.

Project documents

Pede, V., P. Ward, D.J. Spielman, and T. Paris. 2012. *Summary of the Agro-ecological and Socio-economic Context for the Cereal Systems Initiative for South Asia (CSISA).* Project report submitted to CSISA partners and donors. New Delhi: IRRI/CIMMYT/IFPRI/ILRI, October 2012.

Conferences, workshops and seminars

Marenya, P., D.J. Spielman, and E. Nkonya. 2012. Pushing the frontier in the study of conservation agriculture: Considerations for economic policy research. Presentation given at a CGIAR Independent Science and Partnership Council workshop on ‘Conservation Agriculture: What Role in Meeting CGIAR System-level Outcomes?,’ Lincoln, NE, October 15-17.

CSISA socioeconomics staff. 2013. Cereal Systems Initiative for South Asia (CSISA) Phase II Kickoff Workshop on Socioeconomic Research, Knowledge Management, Project Monitoring, and Evaluation, Dhaka, February 5-6.

Justice, S., A Ahmed, A. Sattar-Mandal, and others. 2013. Rural Mechanization: Policy and Technology Lessons from Bangladesh and other Asian Countries. Workshop sponsored by BRAC, CIMMYT, and IFPRI (through the Bangladesh Policy Research and Strategy Support Program and the Cereal Systems Initiative for South Asia), Dhaka, March 7-8.

Magnan, N., D.J. Spielman, T. Lybbert, and K. Gulati. 2013. Leveling with friends: Social networks and Indian farmers’ demand for agricultural custom hire services. Paper presented at the 2013 Pacific Conference on Development Economics, San Francisco, March 9.