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2016 ANNUAL REPORT

CEREAL SYSTEMS INITIATIVE for SOUTH ASIA IN NEPAL

CSISA

Cereal Systems Initiative for South Asia in Nepal (CSISA-NP)

Annual Report
October 2016

Submitted to:

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International Maize and Wheat Improvement Center (CIMMYT)

Period covered: October 1, 2015 to September 30, 2016

Grant Summary Information

Project Name: Cereal Systems Initiative for South Asia in Nepal

USAID India funded: CSISA-Nepal Mechanization & Irrigation

USAID Washington funded: CSISA-Nepal Agronomy & Seed Systems Scaling

Organization Name: International Maize and Wheat Improvement Center (CIMMYT)

USAID India Grant Amount: $1,000,000

USAID India – CSISA-Nepal Mechanization & Irrigation Project Duration (in months): 24

USAID India – CSISA-Nepal Mechanization & Irrigation Project End Date: June 2017

USAID Washington Grant Amount: $3,075,000

USAID Washington Agronomy & Seed Systems Scaling Project Duration (in months): 48

USAID Washington Agronomy & Seed Systems Scaling Project End Date: September 30, 2018

Report Period: October 1, 2015 to September 30, 2016

Report Due: October 30, 2016

Has this project been granted a no-cost extension? CSISA-Nepal Mechanization and Irrigation has been granted a 4-month no-cost extension to 30 September 2017.

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Acronyms and Abbreviations

Acronym	Full Name
AVRDC	The World Vegetable Center
CIMMYT	International Maize and Wheat Improvement Center
CSISA-NP	Cereal Systems Initiative for South Asia, Nepal
DADO	District Agricultural Development Office
DOA	Department of Agriculture
DSR	Dry-seeded rice
FtF	Feed the Future
GoN	Government of Nepal
ha	Hectare
HH	Household
IRRI	International Rice Research Institute
Kg	Kilogram
KISAN	Knowledge-intensive Sustainable Agriculture and Nutrition project
LLL	Laser Land Leveler
NARC	Nepal Agricultural Research Council
NAMEA	Nepal Agriculture Machinery Entrepreneurs Association
NGLP	National Grain Legumes Program
NWRP	National Wheat Research Program
SEAN	Seed Entrepreneurs Association of Nepal
SI	Sustainable intensification
SP	Service provider
SMEs	Small and Medium Enterprises
SQCC	Seed Quality Control Center
USAID	United States Agency for International Development
ZT	Zero tillage

Cereal and pulse yields in Nepal fall well below regional averages and present rates of increase won't meet long-term domestic requirements. Factors that contribute to low staple crop performance in Nepal include scarce farm labor, poor knowledge of best agricultural management practices, insufficient irrigation and mechanization, and farmers' inability to take risks and invest in new technologies. Also, innovative applied research has long been under-funded and research benefits have rarely reached farmers. Nepal's Mid and Far West development regions are most acutely affected by these constraints as these regions have the highest poverty and receive the lowest investment by the private sector. As a result, the Cereal Systems Initiative for South Asia (CSISA) works in Nepal's Terai plains and mid-hills where the scope for improving farmers' lives through agriculture is greatest.

The Government of Nepal's (GoN) new 20-year Agriculture Development Strategy (ADS)[1] recognizes the need for new science-led innovations, crop diversification options for income generation, strengthened input systems for seed and fertilizer, mechanization to cope with outmigration and an aging agricultural workforce, and enterprise development to create new jobs and extend essential support services to large numbers of farmers. In support of these priorities, CSISA works with partners who can help to rapidly and broadly increase the adoption of sustainable intensification technologies at scale. CSISA's partners include Feed the Future's KISAN project, government agencies, farmers' groups, service providers, agro-dealers, seed enterprises and other private sector companies.

CSISA's 'Scaling Seed and Sustainable Intensification Technologies in Nepal' project pursues the following objectives:

1. Pulse (lentil and mungbean) intensification and diversification, adopted at scale
2. Cropping system-based approaches for sustainably intensifying wheat and minimizing terminal heat stress, adopted at scale
3. Facilitation of efficient and low-risk strategies for the precise and productive use of nutrients
4. Robust seed systems that ensure timely access to elite cultivars and hybrids
5. Scale-appropriate mechanization and irrigation.

These activities are part of a four-year program funded jointly by USAID Washington and USAID India. USAID Washington has provided $3,075,000 over four years to support wheat, lentil and mungbean agronomy; the efficient use of fertilizers; and seed system scaling. USAID India has provided $1,000,000 over the first two years to support CSISA's work in mechanization and irrigation, focusing specifically on increasing the ways in which Indian agricultural technologies can support efficient and climate-smart agriculture in Nepal. The program runs from October 2014 to September 2018.

[1] Agriculture Development Strategy (ADS), 2014

AGRONOMY & SEED SYSTEMS SCALING

Theory of Change and Approach

The yields of cereal crops and pulses in Nepal are well below regional averages, and present rates of increase are insufficient to meet near or long-term domestic requirements. Factors contributing to this underperformance include tightening labor markets, poor knowledge of modern best management practices, insufficient availability of irrigation water and mechanization, and low appetites for risk and capacity for investment among asset-poor farmers. CSISA-Nepal Agronomy and Seed Systems Scaling aims to address these constraints by (1) strengthening seed systems so farmers have timely access to improved varieties and hybrids for pulses, wheat and maize; (2) targeting geographic niches and identifying management practices that enable cropping system intensification through the cultivation of lentil and mungbean; (3) recommending best management practices for wheat, including scale-appropriate mechanization technologies that help farmers plant early and avoid terminal heat; (4) facilitating market development for small-scale technologies that enable precise nutrient management; and (5) supporting the expansion of the private sector for sustainable intensification technologies into the Mid and Far West, including the availability of 'spares and repairs,' and expanding the number of service providers so that farmers in rural areas can gain affordable access to new technologies.

FY16 Indictors of Progress (see Appendix 3)

In FY16, CSISA's Agronomy of Seed Systems Scaling project met or exceeded its targets for all FtF indictors, achieving impact with 7,118 farmers on over 3,000 hectares. Support provided to 425 small and medium-scale enterprises was at the core of much of this success. Encouragingly, CSISA greatly exceeded it gender-disaggregated targets for reaching female farmers, largely through programming on precision spreader technologies which are low-cost entry points for forming new businesses for fertilizer application and crop establishment.

Major Activities and Accomplishments

STRENGTHENED SEED SYSTEMS

- Key interventions across the seed value chain included business mentoring for seed companies, producer groups, dealers and their associations; performance verification of elite cultivars through demonstrations conducted though public-private partnerships; broad-based social marketing efforts aimed at building demand for new seeds.
- Through these activities, the project supported 10 private seed enterprises along with 121 seed producer groups linked to these enterprises. Strengthened value chains led to:
  - Burgeoning demand for commercial sources of pulse seeds to support commercial production of mungbean as a cash crop
  - Private-sector led market development for hybrid maize in the FtF zone
  - Emergence of new public-private partnerships for wheat that provide market incentives for companies to expand into new geographies in the FtF zone where they were previously absent.
- CSISA's focus on business development in seed systems provides a long-term foundation for success with near-term payoffs: the three companies that have most aggressively developed and operationalized new business plans have expanded seed production for wheat and pulses by 1,180 MT (63%) over the last two years.
- If total wheat seed sales by the companies are planted in the field in 2016 as expected, this will represent an approximate increase of 5,000 hectares in the area covered by new wheat varieties since 2014.

SUSTAINBLE LENTIL AND MUNGBEAN INTENSIFICATION AT SCALE

LENTIL

- Climate-based risks impose a significant constraint to lentil intensification, with crop failure a common occurrence due to disease outbreaks (*stemphylum*) in years with significant winter rainfall.
- Based on extensive field surveys, CSISA has identified production niches where lentil yields are reliable in both wet and dry years; these areas can be preferentially targeted for agricultural development programming. CSISA continues to work with development partners on climate resilient agronomic practices, such as bed planting, in these areas.
- Current lentil varieties have poor disease resistance; with the National Grain Legume Program and ICARDA, CSISA is evaluating 100 lentil genotypes from the Mediterranean region to determine if enhanced resilience can be achieved through new genetics.
- CSISA has determined that lentil intensification will only occur at scale if cost-effective risk management strategies are identified and verified at the farm level. In response to this determination, USAID-Nepal has changed their investment emphasis with a reduced focus on lentil in the forthcoming round of FtF programming.

MUNGBEAN

- In collaboration with CSISA and the National Grain Legume Program, seed companies have been evaluating the performance, yield and economic benefits of mungbean under different cropping systems. This work helps the millers identify potential commercial pockets where production will be high.
- CSISA is launching collaborative research with the National Grain Legume Program and a private seed company to identify new mungbean varieties with desirable better agronomic traits including yield, earliness, synchronized maturity, resistance to yellow mosaic virus, and the seed size desired by millers for domestic markets.
- From a base near zero, more than 600 newly adopting farmers were involved in mungbean grain production in the FtF zone in 2016, producing 85 MT of grains with a value of more than US$ 127,000. Millers and seed companies are anticipating a major expansion of mungbean acreage in 2017.

SUSTAINABLE WHEAT INTENSIFICATION AT SCALE

- With the National Wheat Research Program, CSISA conducted varietal evaluations of released and pipeline wheat varieties to assess yield potential and stress tolerance. Newer long-duration wheat varieties (e.g., NL 971) had superior performance across environments and planting dates, suggesting broad adaptability. As a consequence of these evaluations, the Ministry of Agricultural Development (MoAD) has recently instructed the National Seed Corporation (NSC) to stop producing an old variety (NL 297) that did not perform well in these evaluations. Since NSC is the largest wheat seed producer in Nepal, this policy change promises to have a marked impact on adoption rates of elite wheat cultivars in the coming season and beyond.
- To spread awareness about the importance of irrigating wheat in dry winters, CSISA collaborated with the District Agriculture Development Offices in four districts to take advantage of the communication channel with the greatest reach in rural Nepal: community FM radio. CSISA produced a social marketing jingle and deployed it during an extended dry spell in February and March. From a random-sample survey, around 6,000 farmers in the four Terai districts applied an additional irrigation for wheat after hearing the jingle. This initiative provides a first successful test of utilizing radio for

agro-advisory in Nepal, and this program will be expanded in collaboration with the Department of Agriculture.

- In collaboration with private sector machinery dealers, CSISA articulated the investment case for purchasing a zero-till (ZT) seed drill while providing technical training for potential service providers on their operation. From a base near zero when the project started in the FtF zone, more than 40 service providers have purchased seed drills and are establishing crops for their neighbors on a fee basis, thereby creating a critical mass of first adopters and increasing access to this capital-intensive technology.
- To consolidate and mainstream information on best-bet wheat management, a 'Wheat Tips' guide was developed in consultation with the National Wheat Research Program. Similar guides for rice and maize reached more than 70,000 farmers in 2016 through development partners, and CSISA will endeavor for similar scale through the new wheat 'Super Zone' program of the Department of Agriculture.

PRECISION NUTRIENT MANAGEMENT

- CSISA has evaluated the performance of low-cost precision spreaders for the uniform application of seed and fertilizer. Evaluation results from wheat and rice show that the use of a precision spreader for urea top-dressing improves fertilizer use efficiency by 5–10% compared with the farmers' application method. Importantly, there is also a 50% savings in labor costs, which provides additional incentives for small entrepreneurs to develop around the technology.
- CSISA launched an awareness-raising campaign about the importance of uniform fertilizer application in collaboration with District Agriculture Development Offices, agro-dealers, as well as through the USAID-funded KISAN project. Given the high level of farmer acceptance and the identification of a low-cost manufacturer in China, private sector partners have imported more than 300 spreaders in advance of the 2016–17 wheat season.

MECHANIZATION & IRRIGATION

Theory of Change and Approach

Many sustainable intensification technologies are machinery-based and require specialized equipment that is not commercially available for small- and medium-scale farmers in Nepal. The only way to achieve widespread access to scale-appropriate machinery among smallholders is by encouraging the emergence of mechanized service provision models and the market-based supply and repair chains required to support them. Private sector importers, dealers, traders and agents need to ensure farmers' access to scale-appropriate machinery in rural areas, and the government needs to have the capacity to evaluate technology. To address these bottlenecks and bolster the market for scale-appropriate mechanization and irrigation technologies in Mid and Far Western Nepal, CSISA is: (1) holding "design sprints" with Indian manufacturers of 2-wheel tractor seeders and threshers to evaluate and improve the machines for markets like Nepal, (2) supporting CSISA's national partners to establish a machinery testing and training center to evaluate sustainable intensification technologies, (3) supporting the emergence and capacity of service providers through technical trainings and business development services, (4) improving the availability of low-cost irrigation technologies, (5) back-stopping the machinery importers' professional association as well as business networks for agro-dealers, and (6) conducting targeted marketing campaigns at key points in the cropping calendar to generate demand for sustainable intensification technologies.

FY16 Indictors of Progress (see Appendix 3)

In FY16, CSISA's Mechanization and Irrigation project met or came within 5% of its targets for all FtF indictors, achieving impact with 1,394 farmers on over 1,457 hectares. Support provided to 205 small and medium-scale entrepreneurs was at the core of much of this success.

Major Activities and Accomplishments

- Prior to CSISA's efforts, reaper attachments for the 2-wheel tractor were not available in the FtF zone despite the high costs, delays, and drudgery associated with manual harvesting. By emphasizing private sector-led market development, growth in reaper sales continued at an impressive pace, and is now approaching 700 in the last two years (400 in FY16). Reaper service providers are now reaching approximately 6,600 ha per year in rice–wheat cropping systems, increasing average farm-level profitability by US$ 120 when used for both crops.
- More than 1,500 farmers applied new mechanization-based technologies during the reporting period, including reapers, 2- and 4-wheel tractor-mounted seeders, push-row maize planters, and technologies that improved water management and irrigation.
- Solar pumps provide a 'climate smart' (i.e., low greenhouse gas emission) irrigation option with very low operating costs, permitting farmers to build resilience to drought by irrigating when needed without confronting the high price of diesel fuel. Nevertheless, adoption of these pumps has been extremely low due to the very high purchase costs. With public and private partners, CSISA is working to design and commercialize the *Sasto Solar Sichai*, which will aid in expanding solar-based irrigation by reducing purchase costs by at least 25%.
- A second major impediment to the spread of shallow tubewells is the high cost of well installation. CSISA has designed a boring kit that could turn the 30,000 2-wheel tractors owners in Nepal into low-cost tubewell installation providers, thereby overcoming the initial cost impediments that prevent many farmers from accessing the abundant groundwater in the region.

OBJECTIVE 1: STRENGTHENED SEED SYSTEMS

Enabling Nepali farmers to adopt improved crop varieties is fundamental to raising productivity and developing greater resilience to biotic and abiotic stresses. Timely access to quality seed with locally-relevant genetic traits (e.g., high yield potential, resilience to biotic and abiotic stresses, nutritional quality) in combination with best agronomic practices and reliable inputs can significantly improve crop productivity, livelihoods, and profit margins of smallholder farmers in the food-insecure West, Mid-west and Far West Nepal. Improved access to high-quality seed must be accomplished through strengthened seed systems – 'one off' interventions such as seed giveaways rarely have lasting benefits.

For wheat and rice, most farmers in Nepal grow improved rather than 'local' varieties. That said, the varietal replacement rate is very low and the most commonly cultivated varieties are old, disease-prone, and have comparatively low yield potential. For maize, there is some market penetration of high-yielding hybrids in the Terai but cultivation in the hills is almost non-existent, even though productivity gains of around 1 t/ha are possible with no change in management under rainfed conditions. Pulse areas, in general, continue to be dominantly sown with local landraces.

Most seed initiatives for staples face the daunting challenge of trying to develop markets while they invest in R&D and production capacity. Simply put, most farmers in Nepal are not aware of the yield and economic benefits achievable with varietal replacement and at the seed company and dealer levels, varieties chosen for multiplication or sale are not choices that are evidence-based. CSISA works to close knowledge gaps about the yield performance of elite pulse (lentil and mungbean) and wheat cultivars, and registered maize hybrids, through networks of community-based evaluations that provide crucial science-led insights and demand generation for seed companies, seed dealers, and among farmer-clients for these businesses. Whenever feasible, these evaluations are co-sponsored by seed companies, the Department of Agriculture, and the Nepal Agricultural Research Council.

In the past decade, six micro-scale seed enterprises have emerged in the central and western Terai. These companies remain in the nascent stages of development and do not have a significant market presence in the Feed the Future zone. CSISA works directly with those enterprises who wish to grow their business. These companies are given marketing advice, inclusive of branding and strengthened distribution channels, as well as guidance on quality control and best production practices.

At the seed dealer level, CSISA works to improve distribution channels for seed from regional companies (e.g., for maize hybrids) and from Nepali companies (e.g., for wheat, lentil, and mungbean). This is achieved in consultation with KISAN and other market development initiatives that prioritize dealer strengthening. In addition to deepened relationships with seed companies, CIMMYT has strong relationships with all the major maize seed companies that have registered hybrids in Nepal (e.g., Bayer, Bioseed, Monsanto). These companies are eager to expand their market presence in Nepal's FtF zone and rely on our science, development, and business contacts in the Mid and Far-West to play an important brokering role in this process. Demand for new seeds is being generated in partnership with KISAN, DoA, and seed companies through advertising and social marketing campaigns that alert farmers to the economic and yield gains associated with varietal replacement.

CSISA has taken a public-private partnership approach to scale out farmers' preferred varieties and hybrids, and to strengthen linkages between formal and informal seed systems. This aligns with the

Nepal government policy documents such as National Seed Vision (2013–2025), Agricultural Development Strategy (2014), and National Seed Summit report (2015).

During the reporting period, business mentoring was extended to 10 private seed enterprises and 121 seed producer groups and cooperatives. A total of 2,157 households planted improved seeds of cereals (wheat, maize and rice) and legumes (mungbean and lentil) covering 1,063 ha.

Key lessons learned during the project implementation include:

- CSISA initiated its support to Nepali seed companies with exposure visits to established companies in India and by holding 'theory of change' workshops that served as a primer on envisioning the steps required to grow. Thereafter, we've implemented a 'one-to-one' direct mentoring approach that implicitly acknowledges that each seed business is unique with different crop focus, investment capacities, dealer and producer networks, and geographic areas of operation.
- Public-private partnerships work best when the project acknowledges, values, and respects partners' existing business strategies and then adds value to them, instead of proposing completely new operational models.
- Nepali seed companies particularly benefit from guidance on high-quality branding and maintenance breeding, which are both important components of creating, marketing and scaling quality seed products.

1.1 KISAN-supported input dealers stock registered maize hybrids

Prior to 2016, there were no maize hybrids officially registered with the Government of Nepal for planting in the FtF zone. This meant that the private sector could not actively build markets for hybrids, and that the few farmers that were cultivating them were acquiring seed through 'grey' market channels without the benefit of research-based recommendations on which hybrids performed best. In collaboration with the National Maize Research Program, CSISA generated field data on the performance of hybrids that had been registered elsewhere in Nepal and then facilitated the geographic expansion of the registration for four of the top performers (Rajkumar, Bioseed 9220, TX 369 and Nutan). To capitalize on this development and seeing a new market opportunity, NIMBUS, a feed mill and inputs company, carried out 1,500 demonstrations with their own resources in five FtF districts in 2016. Based on farmer enthusiasm for the performance of these hybrids, NIMBUS will expand the number of company-sponsored demonstration to 2,500 participating farmers in 2017. In addition to demonstrations, 12 agro-retailers started marketing and stocking these hybrids with more than 800 farmers purchasing seed at full price.

1.2 Private seed companies expand businesses for wheat and pulses

During the mentoring period, three companies (New Shreeram, Unique and GATE) stood out in the manner that they strengthened and operationalized their business plans with support from CSISA. The volume of seed sold by these enterprises has increased by an average of 63% since 2014 (Fig. 1), with approximately 50% of total sales constituted by wheat. If total wheat seed sales by the companies are actually planted in the field in 2016 as expected, this will represent an approximate increase of 5,000 hectares in the area covered by new varieties since 2014; these numbers will be verified in the field and included the FY17 mid-term and annual report.

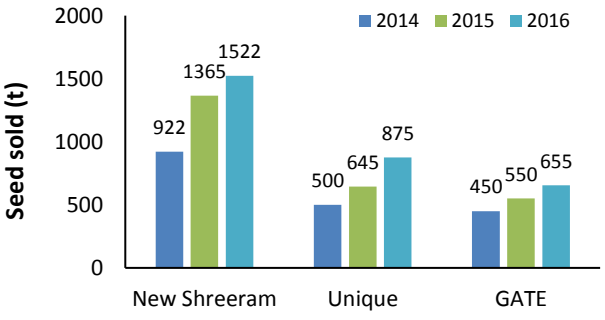

FIGURE 1. SEED SOLD BY CSISA-SUPPORTED COMPANIES

These seed companies are keeping up with demand by developing contractual relationships with 121 farmers' groups and cooperatives to increase seed production. They are also looking forward and planning to take advantage of the emerging business opportunities afforded by emerging wheat varieties. A new wheat line (BL 4341), which resembles NL 297, a popular but disease-prone variety, was prioritized for registration by next year. Seeds of two pipeline varieties (Munal and Chyakhura) and two recently released varieties (Banganga for Terai, Sworgadwari for hills), were multiplied by the companies with assistance from CSISA in 2015–16 so that participatory evaluations can be implemented by the private sector at scale across 15 FtF districts in the forthcoming winter season.

For mungbean, a value chain-driven model was adopted that aligns the interests of millers, seed companies, and farmers' groups/cooperatives in order to expand production of elite varieties with the correct end-use characteristics for market. A private seed company (GATE Nepal) produced 10 MT of mungbean seed for next cycle planting, which is significantly higher than the previous year's sale (Fig. 2). Varietal diversity in the seed company also increased from 2 to 6 including the introduction of a new variety (Panta Mung 5) from India that was facilitated by CSISA. GATE Nepal reports that 80% of the total mungbean seed stock has already been booked by government offices and agro-dealers, and the company is seeking additional seeds through farmers' groups/cooperatives in the Eastern Terai and from Indian seed companies to meet anticipated demand. Mungbean area is expected to increase to at least by 1,000 ha next year.

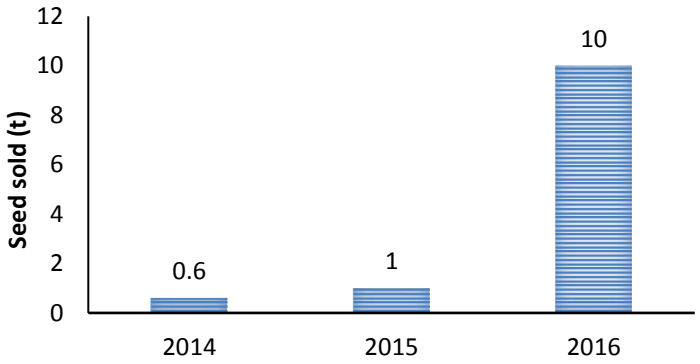

FIGURE 2. MUNGBEAN SEED SOLD BY GATE NEPAL SINCE 2014

1.3 Enhanced partner coordination and an enabling environment for change among seed systems actors

CSISA has leveraged a diversity of entry points for enhancing coordination and creating an enabling environment for seed system strengthening:

New Models of Public-Private Partnership: Rather directly purchasing and distributing seeds, District Agricultural Development Offices in several FtF districts are now subsidizing participation in markets, thereby drawing in the private sector to areas where seed value chains are relatively weak.

Demand generation: An aggressive mass media campaign was conducted to disseminate information about the economic benefits of new wheat and mungbean varieties in order to develop demand. The campaigns were conducted through the distribution of leaflets to through private companies and extension workers as well as through TV and FM radio (three times on national TV, 50 times on local TV and FM radio).

Public policy: The proceedings of the National Seed Summit (2015) were developed with CSISA's technical facilitation, and outline the government's short and long-term goals for the seed sector, as well as outline of the roles of various partners in the seed sector. Recommendations contained in the Seed Summit proceedings are now part of government policy. Practical decisions are starting to emerge as outcomes of the summit. For example, it was agreed that subsidies should only be used to support the popularization of new varieties. In October 2016, the National Seed Company (the largest producer of wheat seed in Nepal) decided not to subsidize seed of an old wheat variety (NL 297) in favor of newly released varieties.

OBJECTIVE 2: SUSTAINABLE LENTIL AND MUNGBEAN INTENSIFICATION AT SCALE

Key lessons learned during the project implementation include:

- Lentil remains a highly risky crop, suffering from disease in wet winters and drought in dry ones. Pockets exist where performance is relatively stable and should be preferentially targeted for development assistance. At the portfolio level, lentil should receive less investment than other pulse and winter crop alternatives.
- Mungbean is low-risk pulse alternative to lentil that can be cultivated after winter crop harvest when fields are typically fallowed. Market demand is strong for mungbean, but for farmers to capitalize on this demand requires a full value chain approach.

Lentil

Lentil is a prioritized value chain for Feed the Future in Nepal. However, the intensification possibilities for this crop have proven difficult to identify because lentil is highly susceptible to drought, excess soil moisture, and disease. In Nepal, farmers grow lentil without investing significant financial resources or agricultural inputs (such as fertilizer) precisely because yields vary so much from year to year. In most locations in the Terai, average yields hover around 600 kg/ha without much advantage gained by planting new varieties that have been registered.

In light of this situation, CSISA conducted a household survey of 600 farm households in its working districts in 2014–15 to understand lentil productivity under farmer management. Results suggest that high rainfall was the major predictor of low lentil yields during the study year. About 85% of the farmers obtained a lentil yield lower than 300 kg/ha while 15% of the farmers experienced complete crop failure. Farmers with fields that were medium to lowland (i.e., more poorly drained) had much lower yields due to waterlogging compared to farmers with better-drained fields in upland areas. Additionally, sites with higher rainfall experienced greater incidence of *stemphylium*, resulting in greater productivity losses. Economic analysis of surveyed households (n=600) showed that almost 62% of farmers ended up in financial loss from lentil cultivation (Fig 3).

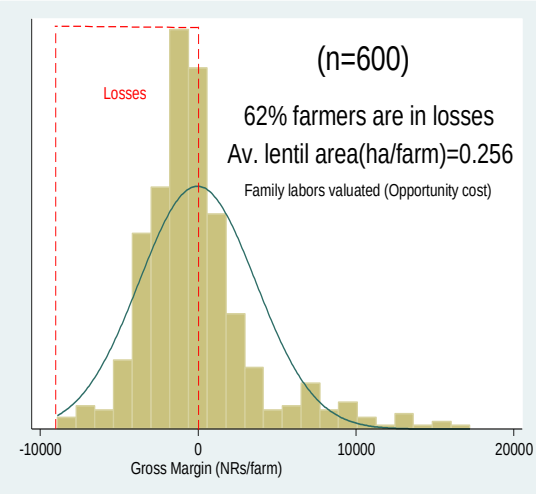

FIG 3: GROSS MARGIN FOR LENTIL PRODUCTION IN CSISA WORKING DISTRICTS

2.1 Targeting and innovative agronomy to reduce risks of lentil failure

For three consecutive cropping cycles (2012–13, 2013–14, and 2014–15), lentil production in the Terai was severely affected by heavy and frequent winter rainfall. More than 80% of farmers obtained yield less than 300 kg/ha, particularly on heavier textured soils. On the other hand, the same amount of winter rain benefitted lentil crops in the hills, where farmers obtained > 2 t/ha because the sloping topography and coarser textured soils facilitate drainage.

This scenario was reversed during the winter of 2015–16, when lentil production was severely affected in the hills and in well-drained soils in the Terai due to a prolonged drought associated with El Niño. The low rainfall was favorable for Terai areas that have medium-to-heavy textured soils (Fig. 4). All of this data verifies that climatic stress is one of the major constraints for lentil production and

that existing germplasm has limited ability to confer resilience during both wet and dry winters. In the absence of suitable genotypes, all of the agronomic interventions tested by CSISA, such as bed planting, failed under unfavorable weather conditions.

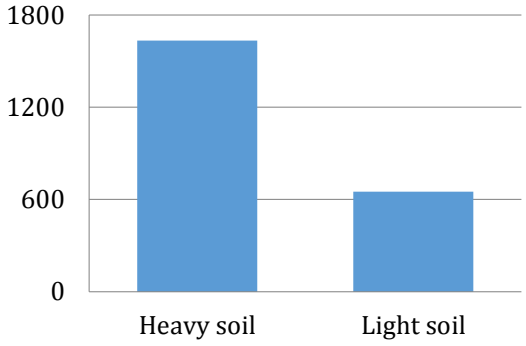

Fig. 4 LENTIL YIELD (KG/HA) ON HEAVY (POORLY DRAINED AND LIGHT SOIL (WELL DRAINED) SOIL IN TERAI IN 2015–16

Research results from the National Grain Legume Program demonstrate that 2–3 sprayings of fungicide during the winter significantly reduces the incidence of *stemphylium*, hence increasing grain yield. The key, however, is to guide the safe and economic use of fungicides in a crop where farmers are not accustomed to using inputs. CSISA will collaborate with the National Grain Legume program to use agro-climatology to derive decision rules for effective and economical fungicide use when warranted by weather conditions.

2.2 Can better genetics reduce the risks to lentil cultivation?

CSISA is collaborating with the Agronomy Division of NARC, National Grain Legume Program (NGLP), and ICARDA to evaluate 100 lentil genotypes from the Mediterranean region for drought and high moisture resistance[2]. Among the tested genotypes in 2015-16, 5 lines were observed to be resistant to drought in a year without winter rainfall. Further screening of these lines is required in the more common wet winters to determine if the same lines are adapted to both drought and waterlogged conditions. If resistant genotypes are identified with broad adaptability to wet and dry winters, on-farm evaluations of the selected genotypes will be carried out in collaboration with seed companies to push towards registration and commercialization.

Mungbean

The rice–wheat rotation is the dominant cropping pattern in the Terai, with wheat harvest in April followed by rice transplanting in July, and there is a **window of opportunity for systems intensification** after winter crop harvest that is not currently utilized by most farmers. Short-duration mungbean is an ideal crop to fill this window in areas where irrigation water is assured. Moreover, the market demand for mungbean is strong, implying that the dual goals of income generation and improved household nutrition might be achieved with its cultivation. It also provides a low-risk alternative to lentil for pulse inclusion in the cropping system.

Despite its promise, mungbean is not commonly cultivated in the FtF zone. In tandem with market development efforts, CSISA focuses on evaluating and refining management practices for mungbean so that production and profitability are assured and that millers and traders can target the most promising areas to expand production.

2.3 Targeting and managing mungbean production to increase yield

CSISA collaborated with NARC, seed companies and producer groups to evaluate of mungbean performance in different cropping systems. Due to earlier establishment, the highest grain yields (~ 1 t/ha) were obtained when mungbean is seeded after harvest of mustard and potato. Comparatively low yield was observed for mungbean that followed wheat (Fig. 5). Mungbean is profitable in all

[2]In a joint review and planning meeting last fall Dr. Renuka Shrestha, Chief, Agronomy Division, NARC, that historically, most lentil varieties in South Asia have been selected by national and international centers from sub-tropical nurseries. She pointed out that Nepal's winters are more of a Mediterranean type than sub-tropical.

systems, but can be first targeted to pockets where potato and rapeseed production predominate in the winter months. In potato-based systems, profitability can exceed $1,000 per hectare.

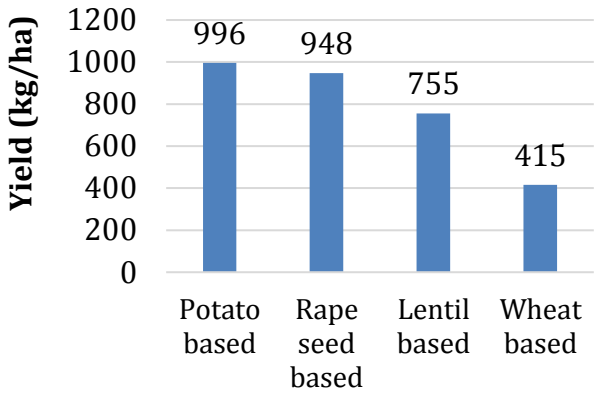

Fig. 5 MUNGBEAN YIELDS IN DIFFERENT CROPPING SYSTEMS

To date only three varieties (which are long duration and require multiple picking) have been registered in Nepal. Realizing the importance of early and synchronized maturity-types, CSISA collaborated with National Grain Legume Program, The World Vegetable Center, GATE Nepal (a seed company), millers (Pathak Khadhya Udhyog) and a farmers' group to assess new varieties. Among the tested varieties HUM-16 (pipeline variety) and Panta Mung-5 (introduced from India by a seed company) have performed well in terms of traits valued by farmers including yield, earliness, synchronized maturity, and resistance to insect pests. During a joint monitoring visit, representatives from the Crop Development Directorate (CDD), Seed Quality Control Center (SQCC), and the National Grain Legume Program agreed to expedite the registration of those varieties after one more year of evaluation.

2.3 Expanding mungbean cultivation through market facilitation

To bring mungbean opportunities to scale, CSISA has helped build a public-private partnership model that is driven by market-orientation. Our role in this process includes: facilitating contractual arrangements between the seed companies and agricultural cooperatives for seed production, coordinating cluster-based grain production between traders and farmers' groups, and providing technical training to mill-supported technicians, extension staff, and to lead farmers through government cooperatives. In response to the strong emerging demand, GATE Nepal has produced 10 tons of mungbean seed to meet the anticipated seed requirement for 2017 – a ten-fold increase in a single year. GATE reports that 80% of the total mungbean seed stock has already been sold, and the company is exploring the possibility of importing additional seed to meet demand.

In 2016, more than 600 farmers were newly engaged with mungbean grain production and in aggregate produced 85 tons of grains with a market value of $127,000. To stimulate the further expansion of mungbean area, CSISA has produced a documentary (http://csisa.org/newsroom/videos/) that was broadcast on national television reflecting the cultivation practices and advantage associated with its cultivation. Efforts are underway to carry out community-level video campaign in the strategic locations in collaboration with media, millers, seed companies and DADOs. In the potential niches, CSISA will focus on awareness raising of farmers on mungbean production technology, and carry out participatory market develop to coordinate the actions millers, seed companies, and farmers. Millers anticipate that mungbean area will expand by at least by 1,000 ha in 2017.

OBJECTIVE 3: SUSTAINABLE WHEAT INTENSIFICATION AT SCALE

Wheat grows widely across Nepal's Terai plains and mid-hills regions and contributes to millions of farmers' livelihoods and household diets. In the Terai, wheat productivity is threatened by shorter winters and **terminal heat stress during grain filling** – a worsening scenario with progressive climate change. In the mid-hills, wheat is vulnerable to damaging **drought** conditions if planted after the last monsoon rains. To assist farmers better cope to rising temperatures and variable rainfall patterns, CSISA collaborates with the Nepal Agricultural Research Council to conduct applied research into how agronomic practices can build resilience. In turn, CSISA aligns with government, civil society, and private sector partners to take these insights to scale.

Key lessons learned during the project implementation include:

- Timely seeding is a precondition for wheat intensification in both the Terai and the hills that ensures higher yield and also higher resource use efficiencies for essential inputs like seed, fertilizer, and irrigation.
- Long-duration wheat cultivars have broad adaptability and superior performance with both early and later sowing.

3.1 Entry points for the sustainable intensification of wheat

3.1.1. Characterizing determinants of wheat productivity in the Terai

Wheat yields in Nepal fall more than 2 t/ha below their potential under good management practices. Ample scope exists to close this yield gap, but opportunities vary across geographies and need to be prioritized according to farmer preferences and investment capacities. CSISA collaborated with the Ministry of Agricultural Development, Department of Agriculture and World Food Program to characterize wheat yield and yield determinants at the household level during the 2015–16 cropping season. Survey results confirmed that seeding time is the major determinant for wheat yield. Yield can be further increased when the crop is seeded early through zero tillage and paired with appropriate fertilizer management along with increased irrigation.

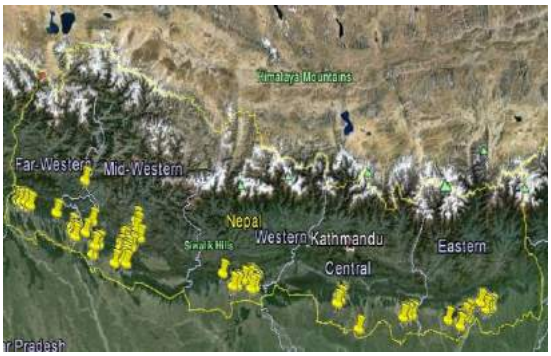

Fig. 6 LOCATING WHEAT SURVEY VILLAGES IN DIFFERENT DISTRICTS

The Government of Nepal has declared Kailali and surrounding districts as the **'Wheat Super Zone**' with the objective of making the country self-sufficient in wheat production. As part of CSISA's efforts to mainstream science-based innovation with partners to accelerate and sustain change, the project will assist the GoN with technical priority setting based on the results of applied research and also survey-based insights into how farmers are actually managing their crops in the different production domains.

3.1.2 Identification of best-bet management practices for early wheat in the Terai

Wheat productivity growth in the Terai is constrained primarily by the farmers' practice of sowing wheat in late November or early December, which leaves the crop to mature (e.g., go through the grain-filling stage) in March, when temperatures can exceed 35 C. In a typical year, the attainable yield potential for wheat declines by about half with delayed planting.

The combination of stress-tolerant varieties, timely seeding and seeding rate adjustments are practices that can help farmers cope with terminal heat stress. In collaboration with the Nepal Agricultural Research Council, CSISA has conducted experiments to validate these practices in the

Date	Variety (grain yield - t/ha)		
	Bijaya	NL971	BL 4316
05-Nov	3.6	4.3	3.8
25-Nov	3.4	4.1	3.9
10-Dec	2.9	3.3	3.3

TABLE 1: WHEAT YIELDS BY VARIETY AND SOWING DATE

Nepal context. Result confirmed that early-seeded with long-duration varieties (i.e. NL971) produced the highest yields (Table 1). Against conventional wisdom, long-duration traits also perform well under late sowing, suggesting broad adaptability, and this message has been conveyed to seed partners in the public and private sectors. Community radio jingles and wheat 'tips' outreach materials have been developed to scale messages on the importance of early sowing in the forthcoming wheat season.

Knowledge of the importance of timely wheat planting is often only half of the equation: farmers also need new technologies to achieve it. Zero tillage can facilitate timely sowing while also reducing crop establishment costs. In collaboration with The Habi, a seed drill trader, CSISA started demonstrating zero tillage (ZT) and reduced tillage wheat during the wheat season 2014–15, which was a completely new technology in the FtF zone. In all districts, ZT wheat out-yielded conventionally seeded wheat.

3.1.3 Wheat intensification in the rainfed hills

As a winter crop, wheat is cultivated during Nepal's dry season, and in the Western mid-hills it is grown mostly as a rainfed upland crop and is susceptible to drought. Under current production systems and existing patterns of input use, wheat productivity (<1.0 t/ha) is very low. Wheat productivity depends on rainfall amounts and distribution because it relies heavily on the moisture left in the soil from late monsoon rains, after maize has been harvested. Under current farmers' practice, even if maize is harvested early, farmers don't plant wheat before the 2ndweek of October, mainly due to a lack of knowledge that wheat can be planted this early. Early seeding into moist soil facilitates proper stand establishment, leading to higher yields, especially in relatively dry winters.

To evaluate the performance of rainfed wheat under different seeding times in the hills, CSISA conducted on-farm evaluation trials in Surkhet. Treatments included three different seeding times for wheat: early (24thSeptember), medium (9thOctober), and late (24thOctober) (Fig.7). The result showed that advancing wheat sowing increased wheat yields by 12-15% compared to the normal planting time.

Fig 7. From Left to Right: PERFORMACE OF WHEAT SEEDED ON 24TH SEP (early), 9TH OCT (medium) AND 24TH OCT (late) IN SURKHET

3.2 Scaling better-bet agronomy for wheat

Deploying agro-advisories through FM radio: More than 80% of farmers in the Mid and Far West irrigate their wheat only once, even if winter rains are scarce and irrigation is available (CSISA survey result, 2015). Many farmers are unaware of the yield benefits of providing a second irrigation to wheat. To build knowledge about the importance of irrigating wheat in dry winters, CSISA collaborated with the District Agriculture Development Offices in four districts to produce radio

jingles in local languages. A household survey conducted after the wheat season shows that 5% of the total wheat-growing farmers heard the jingle, and among those who heard it, 50% applied additional irrigations, a result that demonstrates the power of using radio to disseminate agro-advisories. In FY16, we estimate that 6,000 farmers across four FtF districts in the Terai applied additional irrigation on nearly 2,420 ha.

Collaborating with extension to facilitate early wheat sowing: In the Terai, wheat productivity is threatened by terminal heat. Many farmers delay wheat seeding due to lack of awareness about the benefits of timely wheat seeding. CSISA is collaborating with District Agriculture Development Offices across the FtF zone to broadcast a radio jingle in local languages before the wheat season communicating the benefits of early wheat.

Although the rationale is different (i.e., to minimize drought stress), early sowing is just as important in the mid-hills. Early-sown wheat was the major attraction during a farmer's field day held in March 2016 in Surkhet, with the District Agriculture Development Office (DADO) committing to disseminating this message prior to the 2016–17 wheat season. In collaboration with DADOs in the mid-hills, CSISA is organizing media campaigns to advise farmers to plant wheat early.

Extending better-bet agronomic through simple 'tips': In collaboration with the National Wheat Research Program, CSISA has developed factsheets for better-bet agronomy for wheat from seeding to harvesting to storage. Factsheets are being deployed prior to the start of the 2016-17 wheat season through public and private partners such as District Agriculture Development offices (DADOs), Improved Seed for Farmers project (KUBK), KISAN, and NIMBUS.

Similarly, CSISA will coordinate with the government's forthcoming Wheat Super Zone program in Kailali and surrounding districts, to disseminate basic knowledge on wheat best management practices.

Fig. 8. AGRONOMY TIPS FOR WHEAT INTENSIFICATION

Building a service economy for zero tillage: In collaboration with The Habi, CSISA provided technical training for new service providers on how to calibrate and operate ZT seed drills before the 2015–16 wheat season and more than 230 ha was subsequently seeded. With assistance from CSISA, more than 40 service providers have purchased seed drills and are establishing crops for their neighbors on a fee basis. In collaboration with traders, District Agriculture Development Offices and seed companies, CSISA is generating more demand for ZT through strategically-placed demonstrations, training events, and participation in agricultural fairs with our private sector partners. CSISA has also aired radio jingles on local FM radio stations about the benefits of ZT along with contact information for service providers. At the dealer level, CSISA has placed additional ZT drills in machinery showrooms on a consignment basis so that market availability increases in areas in the FtF zone where machinery retail networks are comparatively weak.

OBJECTIVE 4: PRECISION NUTRIENT MANAGEMENT AT SCALE

In Nepal, fertilizer use is far below the state recommendation for all staple crops. Even so, current fertilizer use recommendations are outdated and applied across very broad areas of the country with few guidelines in place to improve the efficiency of use (e.g., nutrient balance, timing, placement, formulation). Further, existing recommendations were developed on experiment stations under conditions that have very little to do with the realities of on-farm production and the variation that exists at nested scales from the village, to landscape, to region.

Evidence from the central hills of Nepal demonstrates the power of 'getting it right', with net returns from maize increasing by approximately US$ 400/ha with sensible investments in fertilizer. Three factors play a dominant role in determining how much fertilizer is required to optimize crop growth and economic yield: attainable yield potential at the farm level, indigenous soil fertility, and the efficiency of use of applied nutrients.

Key lessons learned during the project implementation include:

- Time of planting, irrigation, and variety all play a critical role in determining efficient and profitable fertilization practices for wheat. Extension recommendations need to evolve to incorporate these factors in addition to considering variations in soil quality.
- Women farmers have responded very favorably to precision spreader technology and strong opportunities exist to form micro-enterprises. Training in basic business literacy and provision of small loans will help catalyze this outcome.

4.1 Domain and situation-specific soil fertility management strategies

4.1.1 Site-specific fertilizer management for wheat intensification

There is no single 'recipe' for precise and economical nutrient management. Fertilizer requirements depend on the soil type, availability of irrigation, time of crop establishment and variety. A household survey conducted by CSISA during the 2014–15 wheat season in the FtF zone showed that farmers under-fertilized their wheat fields relative to the government recommendation by almost half for nitrogen and rarely applied potassium. CSISA conducted on-farm evaluations to characterize fertilizer response with respect to seeding time, variety, irrigation, and balanced fertility.

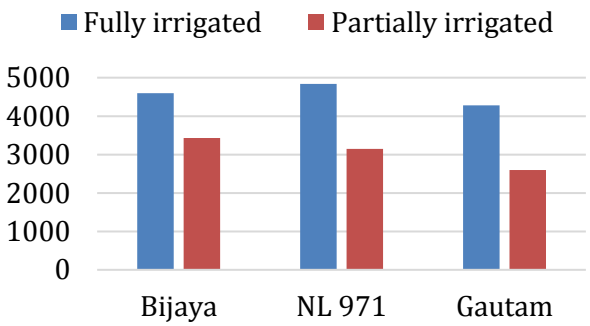

Fig. 9.WHEAT YIELD (KG/HA) WITH RECOMMENDED FERTILIZER AND TWO IRRIGATION LEVELS

Results highlight the importance of considering these factors for devising precision nutrient management strategies: at the same level of fertilizer, the yield in a fully irrigated field (3–4 irrigations) is 35–65% higher than the partially irrigated field (single irrigation).

Similarly, when wheat is seeded on time (before Nov 25), an additional investment of US$ 80 in fertilizer can increase grain yield by more than 1.9 t/ha and profitability by US$ 350/ha. If the same rate of fertilizer is applied to late-sown wheat, no yield advantages are achieved and farmers lose financially.

4.2 Broad-scale awareness of the yield and economic benefits of judicious fertilizer application

Farmers have reported that with the application of 25–30 kg potassium fertilizer per ha wheat **yields increased by 7–10% compared to field without potassium fertilizer**. In the coming wheat season, CSISA will use FM radio to deliver simple messages on the importance of balanced fertilizer and the timing of application on fertilizer use efficiency and wheat productivity.

During the CSISA advisory committee meeting (2nd September 2016), the National Wheat Research Program suggested that the current recommended fertilizer rate for wheat (100:50:25 kg NPK/ha) be updated to 150: 50:50 kg NPK/ha based on collaborative research conducted with CSISA. They also committed to reflecting additional factors of production (e.g., variety and time of establishment) into further revisions of the official recommendations for wheat. New recommendations will be scaled through the Department of Agriculture.

4.3 Accessible technologies identified and commercialized for increasing the efficiency of fertilizer use

Since 2014, CSISA has been demonstrating and evaluating manually operated precision spreader as a low-cost method for increased fertilizer use efficiency. Spreaders not only aid in the uniform application of seed and fertilizer but also reduce labor costs associated with fertilizer application. Evaluation results show that the use of a precision spreader for urea topdressing in rice and wheat improves yield by 5–10%. Just as importantly, there is a 50% savings in labor costs related to fertilizer application.

The manual fertilizer spreader has been strongly received by participating farmers, especially women. To promote scale-out, CSISA has engaged development partners like KISAN as well as private sector importers and their dealers. CSISA has trained more than 150 service providers and also produced a technical guide on the use of the spreader that is being used by partners. Given the high level of farmer acceptance and the identification of a low-cost regional manufacturer, private sector partners have imported more than 300 spreaders in advance of the 2016–17 wheat season.

FIG. 10. CSISA'S GUIDE TO THE SEED AND FERTILIZER SPREADER

OBJECTIVE 5: INNOVATING AND SCALING MECHANIZATION AND IRRIGATION TECHNOLOGIES

India is the regional leader in the commercial production of high-quality agricultural machinery, which is why USAID India's Feed the Future program supports the transfer of Indian innovations to other developing countries. Trade in agricultural machinery between Nepal and India has a long history, with Nepal being one of the largest importers of Indian tractors, estimated at over 5,000 per year with a value of US$ 50 m. The market for Indian machinery is also diversifying, with around 25 combine harvesters being imported to Nepal every year. Yet much more is possible, particularly if Indian manufacturers can become more attuned to market opportunities for scale-appropriate machinery in places like Nepal, Bangladesh, and much of Africa.

For mechanization technologies to spread widely and have a beneficial impact in Nepal, three enabling conditions need to be present: (1) strong supply chains for machinery, spares, and repairs; (2) widespread awareness among farmers (demand 'pull'); and 3) a robust network of service providers to ensure broad access to capital-intensive technologies through custom hiring.

CSISA is working with private sector partners to increase the market for appropriate-scale machinery in Nepal, with a focus largely on seeders, reapers and precision spreaders. To facilitate strong supply chains, CSISA has continued to focus on strengthening importers and their dealer networks through technical training, business mentoring, marketing assistance, and relationship management with Indian manufacturers. In the last year, two new importers of Indian seed drills have been established with CSISA support: Kubier and Sons importing National Agro ZT drills as well UP brands, and SK Traders importing Khedut drills and planters from Rajkot. Habi Auto, the first Nepalese agent of National Agro Industries, conducted demonstrations and farmer field days with backstopping support from CSISA, selling 20 zero-till drills and multi-crop planters in the 2015–16 wheat season. One complication for market development is the ability of farmers to purchase machinery in India at a lower cost (33% mark-up in Nepal for zero till drills). CSISA will continue to monitor this dynamic, which should dissipate with more competition in the Nepal market.

Reaper imports for both 2- and 4-wheel tractors increased over the last year with multiple importers emerging for India machinery. After having seen reapers displayed at the CSISA-funded National Agro Machinery Fair near Nepalgunj, Jaya Bageshwori Tractor and Machines, Nepalgunj, procured over 20 4-wheel tractor reapers (US$ 20,000) from Anmol Reaper of Mansa, Punjab. In CSISA's working districts in Nepal, over 400 2-wheel tractor reapers valued at US$ 200,000 were sold during the reporting period due, in part to the awareness raising and market development activities supported by CSISA. These activities included FM radio spots using simple terms to build awareness of the economic benefits of reaper and seed drill attachments. The project also sponsored the 2nd National Agro Machinery Expo, held in March 2016.

Key lessons learned during project implementation:

- Support for private sector importers, manufacturers and suppliers is critical for strengthening supply chains and moving agro machinery to the FtF zone in the Mid and Far West, where supply chains are poorly-established and it is more expensive to do business.
- District-level sales agents occupy the 'last mile to the farm gate,' and it is important to recognize that their goals and the goals of their suppliers do not always converge (e.g., importers want agents to sell only their products, whereas agents often want to market a diversity of brands and products), necessitating separate support programming at both levels.
- In many cases, ostensibly 'proven' technologies may not find a place in the market even with considerable development investment. While these technologies may have potential in the

future, they can be safely 'put on the shelf' without additional investment until conditions change that favor adoption. CSISA's 'shelf' in Nepal currently includes axial flow pumps, laser land levelers, and rice transplanters.

- Reapers are an example of technology recently pulled from the shelf in response to increasing labor shortages that have farmers desperate to find mechanized alternatives to hand-harvesting. Almost 700 reapers have been sold in the last two years with market facilitation assistance from CSISA.
- While relying on more and more on the private sector is the key to sustainably reaching scale, projects like CSISA need also to respect their investment timelines and appetite for risk.

5.1 Technologies for overcoming energy and cost bottlenecks to irrigation expansion identified

Overcoming the energy and cost bottlenecks to irrigation expansion is one of CSISA's key objectives. Mid and Far Western Nepal lag behind Central and Eastern Nepal in irrigation and groundwater development. CSISA has identified a few technologies that, if developed, could help overcome current bottlenecks.

Axial flow pumps, which CSISA brought to Nepal from Bangladesh for energy-efficient low-lift irrigation, seem to have less potential in Nepal than originally expected – at least in the FtF zone. After acquainting and training our staff to its purpose and usage they have searched out potential locations, but have determined the potential niche is much greater in the eastern region. CSISA will continue low-level programming to capture pocket areas, but with limited investment.

CSISA is applying 'design sprint' principles to the rapid development and testing of two new irrigation technologies. The first product is the **Sasto Solar Sichai** (inexpensive solar irrigation) pumps that could expand solar irrigation beyond high value crops and into field crops like wheat, maize, and rice. Using off-the-shelf and inexpensive components, CSISA has brought down the cost of a 1 kilowatt system from over US$ 2,000 to approximately US$ 1,500. Two systems have been built thus far with the aim towards commercialization by the summer 2017. The project will also bring this prototype to the attention of potential Indian manufacturers with the aim of further reducing costs while ensuring build quality.

Bottlenecks to groundwater utilization in the FtF zone also extend to the high costs associated with tubewell installation. Most shallow tube wells in Nepal are installed manually and can take up to a week to drill. CSISA is working to decrease the time and costs associated with tubewell installation, and has successfully tested a simple and inexpensive **2-wheel tractor drilling kit,** completely built with locally-procured components. The kit allows for much faster drilling of shallow tube wells, and basically turns the 2-wheel tractor into a low cost wench that easily and quickly lifts and drops the drill pipe. With just the 2-wheel tractor shown in the photo to the right, CSISA staff were able to drill down to 90 feet within a few hours. The kit is expected to cost about NR 40,000 (US$ 400), well within the financial reach of many of the 20,000 2-wheel tractor owners in the Terai. With such a kit, 2-wheel tractors could offer low-cost boring services year-round. CSISA endeavors to have the rig ready for commercial partners by mid-2017.

5.2 New business opportunities for laser leveling, zero tillage, and mechanical harvesting defined with expected returns for all value chain actors

Despite positive farmer reception, favorable cost and returns data, and many demonstrations and trainings, demand for laser land leveling services has not materialized in Nepal on a large scale, principally due to the high cost of the equipment and the fragmented nature of landholdings. CSISA has therefore suspended making any significant new investments in this technology beyond acting as a facilitator for Indian companies who wish to continue to invest in market development activities.

CSISA completed a survey of reaper sellers and importers in our working domain in July 2016. CSISA interviewed sales agents, importers and reaper owners in the region, who indicated that over 678 reapers have now been sold and are operating in Mid and Far West regions. The average reaper is harvesting over six hectares in both rice and wheat seasons. This indicates that the total current total area is estimated at 3,313 ha in each season. Response data also revealed that users of 2-wheel tractor-driven reapers save over US$ 63 in wheat harvest costs and US$ 59 in rice harvest costs over non-users.

The survey results also reflected reaper owners' concern that there are few spare parts and trained mechanics available in their area. In September 2016, CSISA trained the mechanics of the main seven reaper dealers in Kailali, Kanchanpur, Surkhet and Dang Districts. These dealers were motivated to provide further trainings to their sub-dealers, as these sub-dealers would get small grants of spare parts (worth about NR 5,000 ($50) each) from CSISA, along with repair and training manuals**.** By end of September seven traders' lead mechanics have provided training to 26 sub-dealer mechanics, who have received or will soon receive their spare parts kits and manuals.

5.3 Advancing attachment design and commercial availability for the 2-wheel tractor and mini-tiller platforms

In order to better orient Indian manufacturers to the smaller machinery markets that are common in places like Nepal, CSISA is working with private sector partners to improve the design of multi-crop seeder attachments for the 2-wheel tractor by conducting 'Design Sprint' workshops along with implementing a direct mentoring approach. The pull out of a key partner in this activity (Georgia Tech University) has delayed regional workshops (Rajkot, Punjab and Odisha), but we plan to hold them in December 2016–January 2017. In the Design Sprint, participating companies qualify for an initial small grant that allows them to design a seeder or thresher prototype on paper. A selection committee will then choose three companies to receive a larger grant to build the prototypes, which would then be tested and test marketed in Nepal. The best of the three will then get an additional small grant to aid in commercialization. The end goal is to improve overall sales of 2-wheel tractor seeders through design advances and high-quality manufacturing.

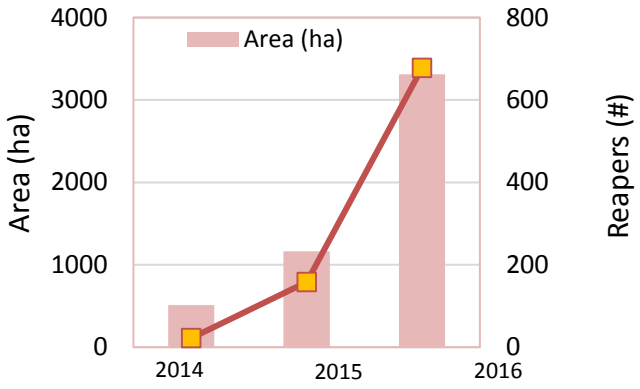

FIG. 11. ESTIMATED REAPER NUMBER AND TOTAL AREA HARVESTED FOR WHEAT IN FY16.

5.4 Improving capacity for machinery evaluation and design improvement among NARES and NAMEA partners in Nepal

and

5.5 Strengthened training facilities and programs for rural- and urban-based agro-machinery repair

The development of these two facilities is the most complicated, time consuming and ambitious activity in the CSISA Mechanization and Irrigation portfolio. CIMMYT's historically close relationship with the Nepal Agricultural Research Council (NARC) has made the process for getting approvals for site selection fairly smooth. For the Department of Agriculture's (DoA) Engineering Directorate, this is the first time CIMMYT has had a sizable joint project with them and permission have taken longer than expected. Partners on both sides remain enthusiastic about establishing the proposed centers and are working hard to finalize the plans.

In March, CIMMYT's Head of Agriculture Engineering, Jelle Van Loon, traveled with the NARC and DoA partners to all potential sites and the team has agreed to recommend the DOA and NARC farms in Nawalpur as the site for the two co-located centers. He has also recommended specific testing equipment for NARC's Machinery Testing Center and DOA's Machinery Training Center. Equipment procurement has been initiated and work will soon commence on site development. NARC will use their facility in part to evaluate the Indian 2-wheel tractor seeder and thresher attachment prototypes emerging from the Design Sprint described above.

5.6 Market development for importers and manufacturers of agricultural machinery

CSISA understands well that any success in scaling agricultural machinery depends on a vibrant, knowledgeable and fully engaged private sector. To this end, CSISA helped form and has continuously supported the Nepal Agricultural Machinery Entrepreneurs Association (NAMEA). Through continuing education programming, CSISA helps to build awareness within member companies of new machinery technologies and to alert them where policy interventions may be required. CSISA also facilitates NAMEA members to extend their market reach into the FtF zone by introducing them to district-level agents and dealers.

The best example of this work has been the establishment of Dahit Traders in Munabasti, Bardiya District. Dahit Traders was established in 2014 in response to the advice of CSISA. Dahit's owner, Mr. Chullu Ram Chaudhary, was a leading service provider for the 2-wheel tractor-operated seed drill and reaper. Within two years of establishing Dahit, it has become one of the largest sellers of 2-wheel tractors and their attachments in the FtF zone. Chaudhary quickly convinced area farmers of the importance of reapers in crop production as they save significant time during harvesting and reduce the harsh impact of labor scarcity. Dahit sold over 40 reapers during the 2015 rice harvesting season and another 20 pieces in the 2015–16 wheat season. Chaudhary indicated that if Nepal had not been suffering a border blockade during five months over 2015-16, he believes he could have sold many more.

FIG. 11. CHAUDHARY (SECOND FROM RIGHT) WITH FARMER AND CSISA STAFF INSPECTING A DSR FIELD.

FIGURE 2 GLIMPSES OF THE NATIONAL AGRO MACHINERY EXHIBITION

CSISA was the prime sponsor of the Second National Agro Machinery Exhibition, held in Kohalpur, Banke District on March 6–10, 2016. The exhibition attracted over 80 agro-machinery importers, manufacturers, and dealers from Nepal and India. CSISA displayed machinery that other traders were not, such as Dashmesh's Happy Seeder and precision fertilizer spreaders. NAMEA organizers reported that companies exhibited to over 35,000 people, and business of over US$ 500,000 worth of goods were either sold or booked during the exhibition.

CSISA has undertaken a campaign of distributing strategic messages via local FM radio stations,

with jingles and mini-dramas written in local languages. Jingles have played an important role in increased sales of CSISA-supported technologies. For example, CSISA developed jingles about reapers in the local Tharu language for airing in the Far West. In the last rice harvest season, Dahit Traders reported that after CSISA aired a jingle using their phone number they received over 100 calls about reapers, and demand outpaced supply. FM radio is proven to be a low cost and highly effective platform for raising awareness of machination technologies. CSISA is working with public and private sector partners to expand the use and effectiveness of radio-based social marketing.

Engagement with Missions, FTF partners and project sub-contractors

USAID Missions

CSISA has engaged with the Nepal mission in the following core areas in FY16:

- Formulated the *Earthquake Recovery Support Program*, which was implemented under the banner of CSISA with funding from USAID-Nepal ($1 m, June 2015 – September 2016). This program leveraged ongoing CSISA work on mechanization value chains to bring scale-appropriate small tractors and attachments to hill communities that lost draft animals and agricultural labor in the devastating earthquakes that affected Nepal in April and May of 2015.
- Convened the first National Seed Summit with USAID-Nepal and the Ministry of Agricultural Development, which informed the design and created political momentum for the recently started *Nepal Seed and Fertilizer* (NSAF) project (US$ 15 m investment). This project was awarded to CIMMYT and is functionally aligned and support by CSISA.
- Provided technical advice and support to the KISAN project (USAID-Nepal's flagship FtF program) on staple crop management.
- Shared technical insights into challenges and opportunities confronting the sustainable intensification of staple crop systems in Nepal that (we believe) have informed the development of the forthcoming KISAN II project solicitation.

FTF partners

The KISAN project, part of USAID's global Feed the Future (FTF) initiative, is a US$ 20 million five-year program working to advance food security objectives by increasing agricultural productivity. KISAN works collaboratively with CSISA by utilizing technical and extension materials and advice to improve the uptake of better-bet sustainable agriculture production and post-harvest practices and technologies for targeted cereals. KISAN has a reach of hundreds of thousands of farmers, who have been exposed to CSISA information, materials, and technologies through this partnership.

Project Sub-Contractors

Both CSISA-Nepal Agronomy and Seed System Scaling and CSISA-Nepal Mechanization and Irrigation have provided sub-agreements to our government partners. CSISA-NP Scaling has provided a grant to the Nepal Agricultural Research Council to fund collaboration with the National Grain Legume Program and the National Wheat Research Program. CSISA-NP Mechanization and Irrigation has developed (they are currently in the process of being signed) sub-agreements for the Nepal Agricultural Research Council and the Department of Agriculture, Engineering Directorate, to fund the Machinery Testing and Training Centers. These subgrants fund the development of training materials and trainings for trainers, as well as service providers, repair technicians, and blacksmiths, as well as the testing of machinery. Sub-grants are complemented by funds available for the direct procurement of equipment for the centers.

Indicators

Indicator data for the two investments covered by this report show that during the reporting period, 'CSISA-Nepal Agronomy and Seed Systems Scaling' came within 10% of our target for the number of hectares under improved technologies, the number of farmers who have applied improved technologies, the number of enterprises and organizations receiving food

security related development assistance and the number of MSMEs receiving business development services. We exceeded the number of individuals who received training by 20%. The main areas of success for this investment, as reflected in the indicators, are our work with scaling better-bet agronomic management for pulses and wheat, precision nutrient management, and the development and scaling of new varieties and hybrids for pulses, wheat and maize. One area to highlight for its inclusion of women and women's groups is our work with the precision spreader, which facilitates the uniform application of seed and fertilizer, and is extremely user-friendly for women. Interest in using precision spreaders as the basis for small enterprises and custom-hire services is increasing among women farmers and women's groups in CSISA's working domain.

'CSISA-Nepal Mechanization and Irrigation' has come within 10% of our target for the number of hectares under improved technologies, the number of farmers who have applied improved technologies, the number of MSMEs receiving business development services, and the number of technologies under research or under field-testing. The numbers reflect our progress in working with service providers and private sector partners to scale up some key scale-appropriate technologies including zero till seed drills, reapers and threshers. Other components of the program are progressing more slowly, including the design sprint and the training and testing centers, but those activities are not captured by our indicator reporting.

Appendix 1 – Staffing

Name	Role	Institution	Address	Phone (+977)	Email
Andrew McDonald	Project Leader	CIMMYT	Kathmandu, Nepal	9808757832	a.mcdonald@cgiar.org
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Appendix 2 – Project subcontractors and key partners

NEPAL				
PARTNER	**PARTNERSHIP OBJECTIVE**	**ALIGNMENT WITH THEMES**	**LEVERAGING OPPORTUNITY**	**STATUS OF PARTNERSHIP**
Government of Nepal				
Ministry of Agricultural Development	Technical guidance for GoN investments in agricultural development	All	New Agriculture Development Strategy approved by GoN in Fall of 2015. CSISA acts as a technical partner to shape the loan and investment programs associated with ADS, which may exceed $100 m USD.	Active and sanctioned by CIMMYT's host country agreement
Nepal Agricultural Research Council (NARC)	Strategic and applied research on SI technologies	Innovation towards impact	NARC is responsible for providing the science basis of all state recommendations; their endorsement and ownership of emerging sustainable intensification technologies is essential.	Active and long-standing
Department of Agriculture (DoA)	Front line extension and support to farmers, service providers, and private sector	Achieving impact at scale	DoA has staff at the district level across Nepal and considerable budgets to support programming; CSISA assist in improving the quality of extension messaging and works to deepen linkages to private sector.	Active and long-standing
Nepali private sector				
Machinery importers (BTL, SK Traders, Dhahal, etc.)	Introduction and market development for scale-appropriate machinery	Achieving impact at scale	Rapid expansion of investment in scale-appropriate machinery and support for emerging service provision markets.	Active and long-standing
NIMBUS	Introduction and market development for new crop varieties and hybrids	Achieving impact at scale	Registration and market development for hybrids in the Feed the Future zone from a base of zero in 2015.	Active since 2015
NGO				
NAMEA	Trade association formed with the help of CIMMYT to	Systemic change	Important voice for private sector with GoN as the Agriculture Development Strategy support programs	Active since 2014

	create an enabling environment and policy dialogue for scale-appropriate mechanization in Nepal	towards impact	take shape.	
SEAN	Trade association strengthened with the help of CSISA to create an enabling environment and policy dialogue for seed system strengthening / SMEs in Nepal	Systemic change towards impact	Important voice for private sector with GoN as the ADS support programs take shape.	Active and long-standing
Universities				
University of Illinois	Strategic research and landscape diagnostics to uncover patterns of spatial variability in crop performance and the contributing factors for yields gaps in Nepal cereal crops	Innovation towards impact	Collaboration with advanced research institution increases the quality of science conducted in Nepal; national partners learn new research methods and contribute to the formulation of new research questions.	Active
University of Nebraska	Opportunities for agronomic practices to conserve water, reduce risk, and enhance yields in maize-based systems in the hills of Nepal	Innovation towards impact	Collaboration with advanced research institution increases the quality of science conducted in Nepal; national partners learn new research methods and contribute to the formulation of new research questions.	Active
Wageningen University	Role of livestock and value chains in farmer willingness to invest in maize	Innovation towards impact	Collaboration with advanced research institution increases the quality of science conducted in Nepal; national partners learn new research methods and contribute to the formulation of new research	Active

	intensification		questions.	
Projects				
Knowledge-based Integrated Sustainable Agriculture and Nutrition (KISAN)	Strategic partnership to co-support on the large scale deployment of extension information and technologies	Achieving impact at scale	The KISAN project, part of USAID's global Feed the Future (FTF) initiative, is a US$ 20 million five-year program working to advance food security objectives by increasing agricultural productivity. KISAN works collaboratively with CSISA by utilizing technical and extension materials, and advice, to Improve the uptake of better-bet sustainable agriculture production and post-harvest practices and technologies for targeted cereals. KISAN has a reach of hundreds of thousands of farmers, who have been exposed to CSISA information, materials, and technologies through this partnership.	Active for 3+
High-value Agriculture Project (HVAP) - IFAD	Opportunistic partnership to take advantage of value chains and entrepreneurial skills created by HVAP, including among women farmers	Achieving impact at scale	HVAP has worked on literacy, numeracy, and value chain strengthening for high value commodities like vegetables. CSISA is taking advantage of the social and market capital created by HVAP to introduce and expand commercial maize production in the mid-hills.	New

Appendix 3. Indicator Numbers Covering October 2015 through September 2016

CSISA-Nepal Scaling (USAID Washington Investment)

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-18: (4.5.2-2) Number of hectares of land under improved technologies or management practices with USG assistance (RAA) (WOG)	This number counts the number of hectares under improved agricultural technologies such as the use of new crop varieties, adoption of sustainable intensification-related agricultural management practices for lentil, mungbean and wheat, and nutrient/soil fertility management practices.			
Technology type			2,850	3,020
crop genetics	This category counts the hectares under new and improved varieties and hybrids of wheat, lentil and mungbean.		1,050	1,063
cultural practices	This category counts the hectares under various risk-reducing and productivity-enhancing cultural practices such as weed management, better-bet crop management, better crop establishment practices, etc.		700	740
pest management				
disease management				
soil-related fertility and conservation	This category captures the hectares under balanced and timely application of fertilizer, and use of the Precision Spreader for uniform application of fertilizer.	We have exceeded the target mainly due to increased use of the Precision Spreader for uniform application of fertilizer. Sales of existing stocks at the agro-dealer level accelerated due to demand-generating activities with partners like KISAN and the Department of Agriculture.	200	296

irrigation	This category captures the hectares under irrigation management practices (surface and groundwater), which fall under the better-bet management practices for lentil, mungbean and wheat.		300	326
water management (non-irrigation)	This number captures various better-bet management practices related to water conservation technologies such as zero-tillage and other direct seeding practices.		600	595
climate mitigation or adaptation				
other				
total w/one or more improved technology			2,850	3,020
Disaggregates Not Available				
Sex			2,850	3,020
Male			1,710	1,590
Female		We exceeded this target mostly because of the increasing number of women who want to practice precision nutrient management, particularly by using the precision fertilizer and seed spreader.	428	703
Joint			570	572
Association-applied			142	155
Disaggregates Not Available				

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-17: (4.5.2-5) Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	This number counts farmer who have applied improved agricultural technologies such as cultivation of new crop varieties, adoption of various cultural practices, nutrient/ soil fertility management practices, irrigation and water management support, and post harvest activities.		6,600	7,118
Producers			6,600	7,118
Sex			6,600	7,118
Male		Although we came within 10% of our overall target, the proportion is higher than expected for women than men because of the increasing interest in precision seed and fertilizer broadcasting equipment.	4,620	4,028
Female		Although we came within 10% of our overall target, the proportion is higher than expected for women than men because of the increasing interest in precision seed and fertilizer broadcasting equipment.	1,980	2,952
Disaggregates Not Available				138
Technology type			6,600	7,118
crop genetics	This number counts farmer who have cultivated new and improved crop varieties of maize, wheat, lentil and mungbean		2,160	2,157
cultural practices	This number counts farmers adopting various cultural practices activities such as weed management, better-bet crop management, better crop establishment practices etc.		1,600	1,687

	livestock management				
	pest management				
	disease management				
conservation	soil-related fertility and	This number captures farmer practicing balance and timely application of fertilizer, use of the Precision Spreader for uniform application of fertilizer.	We exceeded our target mainly due to the increased use of the Precision Spreader for uniform application of fertilizer. Sales of existing stocks at the agro-dealer level accelerated due to demand-generating activities with partners like KISAN and the Department of Agriculture.	800	1,144
	irrigation	This number captures farmer adopted irrigation management practices such as surface and groundwater irrigation in the context of adopting better-bet management practices for lentil, mungbean and wheat.		600	619
irrigation)	water management (non-	This number captures various better-bet management practices related to water conservation technologies such as zero-tillage and other direct seeding practices.		1,200	1,252
adaptation	climate mitigation or				
distribution	marketing and				
and storage	post-harvest - handling	This number captures farmers using post-harvest technologies related to better-bet agronomy and sustainable intensification management practices for lentil, mungbean and wheat. Technologies iclude the use of reapers and threshers, and proper storage and handling of improved seed varieties.		240	259
	value-added processing				
	other				
improved technology	total w/one or more			6,600	7,118

Disaggregates Not Available				

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-4: (4.5.2-11) Number of for-profit private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community based organizations (CBOs) receiving USG food security related organizational development assistance (RAA) (WOG)	This number counts the involvement of private enterprises such as agricultural inputs suppliers, producers, business associations, seed companies, cooperatives, and community-based organizations. These organizations have received assistance from the project for their business management, marketing etc.			
Type of organization			305	315
Private enterprises (for profit)	This number counts the involvement of private enterprizes such as agricultural input suppliers (agrovets), business associations, seed companies, cooperatives, and community-based organizations. Seed groups received assistance on the expansion of business for maize hybrids, improved wheat varieties, and improved pulse varieties. Other types of businesses received assistance related to sustainable intensification technologies for precision nutrient management, zero tillage wheat, and improved lentil and mungbean cultivation.		160	146
Producers organizations	This number captures the involvement of producer groups. These groups received assistance on the expansion of business for maize hybrids, improved wheat varieties, and improved pulse varieties. Other types of businesses received assistance related to sustainable intensification technologies for precision nutrient management, zero tillage wheat, and improved lentil and mungbean cultivation.	More producer groups, especially seed producer and farmer groups received assistance from the project.	100	121

Water users associations				
Women's groups	This number captures the women's groups that received assistance from CSISA on sustainable intensification technologies and management practices, including zero tillage wheat, lentil and mungbean production and precision nutrient management.		30	32
Trade and business associations	This number captures the trade organizations that are involved mainly in trading of improved and hybrid seeds for cereal and pulse crops, as well as and other ag inputs.		15	16
Community-based organizations (CBOs)				
Disaggregates Not Available				
New/Continuing			305	315
New	This year was the first full year of the project, so we were able to provide assistance to many new organizations or groups. Assistance related to the expansion of business for maize hybrids, improved wheat varieties, and improved pulse varieties. Other types of businesses received assistance related to sustainable intensification technologies for precision nutrient management, zero tillage wheat, and improved lentil and mungbean cultivation.		280	291
Continuing	Of the total 25 enterprises that received assistance last year, one did not continue this year.		25	24
Disaggregates Not Available				

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
4.5.2(37) Number of Micro, Small, Medium Enterprizes (MSMEs), including farmers, receiving business development services from USG assisted sources	This number captures the various sizes of the enterprises receiving services on business planning, procurement, marketing/trading, access to business development services, etc.		425	425
MSME Size			425	425
Micro	This number counts number of enterprises having 1-10 employees. Provided services include access for new market for small enterprise products, access to input markets, and establishment of linkages between enterprises. Enterprises in this category included the smallest seed companies, entrepreneurial farmers' groups, agro-vets and service providers.		420	419
Small	This number counts number of enterprises having 11-50 employees. Provided services include enterprise planning and operations management, improvement of technical expertise, and estabishing linkages between service providers. This category is composed mostly of seed companies, since some of them are larger than our "micro" enterprises, like agro-vets and service providers.	Exceeding the target is mainly due to small target, making the actual figure appear to be a significant deviation. There was one additional seed company in this category than we targeted for.	5	6
Medium				
MSME Type			425	425
Agricultural producer	This category captures our market-oriented farmers' groups.		120	126
Input supplier				
Trader	This category captures our seed companies.	Increase in percentage is mainly due to small target, the actual figure appears to be a significant deviation.	5	6
Output processor				
Non-agriculture				

Other	This category captures our agro-vets and service providers.		300	293
Sex of producer			425	425
Male	This category is mostly composed of service providers.		255	258
Female	This category is mostly composed of farmers' groups.		85	81
Joint	This category is mostly composed of agro-vets and seed companies.		85	86
Disaggregation not available				

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-1: (4.5.2-7) Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training (RAA) (WOG)				
Type of individual		More people than anticipated were interested to join CSISA's trainings on better-bet agronomic practices and seed production trainings / business development services trainings.	400	481
Producers	This number counts producer trainees who attended training courses on better-bet agronomic practices and sustainable intensification technologies for pulses, wheat, precision nutrient management and seed production.	We exceeded the target because many producers were interested to join trainings on better-bet agronomic practices and sustainable intensification technologies for pulses, wheat, precision nutrient management and seed production. This year, CSISA expanded/shifted into new geographies and moved out of Dadeldhura, where technology update was not high. We have moved into Dang, where the scope for adoption of sustainable intensification technologies and management practices is signficant. Therefore, the number of new trainees exceeded the target.	250	339
People in government	This number counts training participants representing government sector, mainly District Agriculture Development Offices.		75	70
People in private sector firms	This number counts training participants representing private seed companies, agri-input suppliers (agrovets), and cooperatives etc.		40	38
People in civil society	This number counts training participants representing local non-governmental organizations and community-based organizations.		35	34
Disaggregates Not Available				
Sex			400	481
Male			325	328
Female		We exceeded this target because a high number of women and women's groups were interested to participate in the better-bet agronomy and precision fertilizer broadcasting trainings.	75	153

Disaggregates Not Available				

CSISA-Nepal Mechanization and Irrigation (USAID India Investment)

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-18: (4.5.2-2) Number of hectares of land under improved technologies or management practices with USG assistance (RAA) (WOG)				
Technology type			1,500	1,457
crop genetics				
cultural practices	This number captures the spread of direct seeding technology in rice (DSR) and zero tillage technology (ZT) in wheat.	Spread of these technologies is through service providers, and sales of new machinery have increased more rapidly than anticipated. Therefore we have exceeded the target.	60	109
pest management				
disease management				
soil-related fertility and conservation		Normally in CSISA, this category captures the spread of the Earthway Spreader and practices of improved soil fertility (fertilizer efficiency) management. However, that intervention is actually an approved activity under the complementary investment by USAID Washington called, "CSISA-Nepal Agronomy and Seed Systems Scaling", under Theme 4, "Facilitating efficient and low-risk strategies for fostering precise and productive use of nutrients". Therefore, we have not reported any actuals here, and have reported them there instead.	30	0
irrigation				

water management (non-irrigation)	This number captures the spread of laser land leveling technology.	Although the number of machines in Nepal is still limited, farmers' desire to use this technology increases steadily. We have therefore exceeded the target.	30	40
climate mitigation or adaptation				
other	This number primarily captures the spread of reapers for harvesting and threshers for post-harvest management.	The dramatic increase in the popularity of reapers has allowed us to come within 10% of this ambitious target (although slightly missing it). The business case for purchasing reapers is very strong, with new service providers paying back the cost of the machine within a season, in most cases.	1,380	1,308
total w/one or more improved technology			1,500	1,457
Disaggregates Not Available				
Sex			1,500	1,456
Male		Our M&E system increasingly allows us to identify the gender of our beneficiaries, so a higher number have been categorized as male/female than originally expected. However, the overall total is still very close to the target.	70	128
Female		Our M&E system increasingly allows us to identify the gender of our beneficiaries, so a higher number have been categorized as male/female than originally expected. However, the overall total is still very close to the target.	25	49
Joint				

Association-applied	This category captures farmers' groups and cooperatives.	Farmers' groups and cooperatives have shown increasing interest in technologies such as the Earthway spreader. Therefore, CSISA has been able able to work with more groups than expected.	25	34
Disaggregates Not Available	This category captures the hectares covered by service providers and though machinery sales through dealers, so the gender disaggregation is often not readily available.	We were able to categorize more of the total as male or female, which means that the number in disaggregates not available was lower than expected.	1,380	1,245

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-17: (4.5.2-5) Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)				
Producers			1,500	1,394
Sex			1,500	1,394
Male		Our M&E system increasingly allows us to identify the gender of our beneficiaries, so a higher number have been categorized as male/female than originally expected.	350	419
Female		Our M&E system increasingly allows us to identify the gender of our beneficiaries, so a higher number have been categorized as male/female than originally expected.	150	237
Disaggregates Not Available		The farmers categorized in disaggregates not available have been reached through intermediaries, so the gender is often not readily available.	1,000	738
Technology type			1,500	1,394
crop genetics				
cultural practices	This number captures the spread of direct seeding technology in rice (DSR) and zero tillage technology (ZT) in wheat.	Spread of these technologies is through service providers, and sales of new machinery have increased more rapidly than anticipated.	225	259
livestock management				
wild fishing technique/gear				
aquaculture management				
pest management				
disease management				

conservation	soil-related fertility and		Normally in CSISA, this category captures the spread of the Earthway Spreader and practices of improved soil fertility (fertilizer efficiency) management. However, that intervention is actually an approved activity under the complementary investment by USAID Washington called, "CSISA-Nepal Agronomy and Seed Systems Scaling". The activity falls under "Theme 4, Facilitating efficient and low-risk strategies for fostering precise and productive use of nutrients". Therefore, we have not reported any actuals here, and have reported them there instead.	125	0
	irrigation				
irrigation)	water management (non-	This number captures the spread of laser land leveling technology.	Although the number of machines in Nepal is limited, desire to use this technology by farmers increases fairly steadily. We have therefore exceeded the target.	75	91
adaptation	climate mitigation or				
	marketing and distribution				
storage	post-harvest - handling and	This number captures the spread of reapers and threshers.		575	557
	value-added processing				
	other	This number captures the farmers who are employing improved and mechanized technology for crop management, including motorized sprayers.		500	487
technology	total w/one or more improved			1,500	1,394
	Disaggregates Not Available				

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
4.5.2(37) Number of Micro, Small, Medium Enterprises (MSMEs), including farmers, receiving business development services from USG assisted sources			200	205
MSME Size			200	205
Micro	This category captures the number of farmers' groups, cooperatives, service providers and agro-dealers who received training on business development services for laser land levelers, theshers, reapers, and seed drills for zero tillage and direct seeding.		200	205
Small				
Medium				
MSME Type			200	205
Agricultural producer	This category generally reflects trainings for farmers groups.		35	37
Input supplier			30	31
Trader	This category generally reflects trainings for traders.	Because of the small target, the actual figure appears to be a significant deviation. However, the number mostly reflects that reaper traders have shown increasing interest to work with CSISA because of the dramatic spread of the technology.	5	6
Output processor				
Non-agriculture				
Other	This category generally captures trainings provided to service providers and input suppliers.		130	131
Sex of producer			200	205
Male				
Female				
Joint			70	72
Disaggregation not available			130	133

Indicator / Disaggregation	2016 Comment	2016 Deviation Narrative	2016	
			Target	Actual
EG.3.2-7: (4.5.2-39) Number of technologies or management practices under research, under field testing, or made available for transfer as a result of USG assistance (RAA)				
Phase 1 Number of new technologies or management practices under research as a result of USG assistance	This category captures solar pump irrigation systems, open drum threshers operated by two-wheel tractor, two-wheel tractor-operated boring digger, and experiments with the maize weed mower.		4	4
Phase 2 Number of new technologies or management practices under field testing as a result of USG assistance	This category captures the walk-behind spreader, hand-held spreaders, axial flow pumps for irrigation, zero till seed drills for lentil and bed planters for lentil.		5	5
Phase 3 Number of new technologies or management practices made available for transfer as a result of USG assistance				
Disaggregates Not Available				