



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

Agronomy & Seed Systems Scaling

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Acronyms and Abbreviations

Acronym	Full Name
ADS	Agriculture Development Strategy
CIMMYT	International Maize and Wheat Improvement Center
CSISA-NP	Cereal Systems Initiative for South Asia in Nepal
CSRD	Climate Services for Resilient Development
DADO	District Agricultural Development Office
DoA	Department of Agriculture
FtF	Feed the Future
GoN	Government of Nepal
ha	Hectare
kg	Kilogram
KISAN	Knowledge-intensive Sustainable Agriculture and Nutrition project
NARC	Nepal Agricultural Research Council
NGLRP	National Grain Legumes Research Program
NSAF	Nepal Seed and Fertilizer project
PMAMP	Prime Minister's Agriculture Modernization Project
SEAN	Seed Entrepreneurs Association of Nepal
SQCC	Seed Quality Control Center
USAID	United States Agency for International Development
ZT	Zero tillage

Program Overview

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) 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 (The majority of this component was funded by USAID India and closed in September 2017.)

These activities are part of a four-year program funded jointly by USAID Washington and USAID India. USAID Washington has pledged \$3,000,000 over four years to support wheat, lentil and mungbean agronomy; the efficient use of fertilizers; and seed system scaling. USAID India 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-resilient agriculture in Nepal. The USAID Washington program runs from October 2014 to September 2018. The USAID component closed on September 30, 2017.

Note: *This report reflects a 6-month period when the project's funding became both uncertain and delayed. At one point, it was made clear that there would be no additional funding and that the project should move towards closure. As a result, most of the activities were thereafter suspended or shrunk as we wait to see if funding for FY18 becomes available. This report reflects that status, even though funding may still come through.*

¹[Agriculture Development Strategy \(ADS\), 2014](#)

AGRONOMY & SEED SYSTEMS SCALING

Theory of Change and Approach

Cereal and pulse yields 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 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.

Major Activities and Accomplishments

STRENGTHENED SEED SYSTEMS

- **Technical guidance for seed companies:** Nepal's top four seed companies established 50 large-plot demonstrations of new and pipeline varieties in collaboration with seed producers' groups at their own cost. More than 4,000 households visited the demonstrations during the wheat season. CSISA provided technical guidance to these seed companies on the selection of new and promising crop varieties for inclusion in the large-plot demonstrations and technical training to their technicians on best management practices. In the past, seed companies in Nepal have been mostly passive participants in markets. By conducting and financing their own demonstrations, the companies mentored by CSISA are now focused on growth and investing accordingly.
- **Replacing old varieties with newly released ones:** CSISA significantly contributed to the emergence of strong, sustainable, and market-oriented seed systems by strengthening the capacity of the Seed Entrepreneurs' Association of Nepal. Seed sales of the 35-year old variety, NL-297, are declining and sales of newly released varieties are increasing.

SUSTAINABLE LENTIL AND MUNGBEAN INTENSIFICATION AT SCALE

Lentil

- **Stakeholders' meeting on lessons learned for lentil production in Nepal:** CSISA organized a stakeholders' meeting to facilitate the sharing of knowledge and lessons learned on lentil cultivation. The meeting aimed to help guide research and development priorities and action plans for combatting the primary threats to lentil production in Nepal.
- CSISA is collaborating with the USAID-funded Climate Services for Resilient Development project and the National Grain Legume Research Program on a **lentil**

stemphylium disease monitoring study across the mid- and far- western Terai districts. The outcome of this study (expected to be ready by June 2018) will be helpful for predicting onset and severity of stemphylium disease in lentil, while considering climate and management factors.

Mungbean

- The mungbean season in Nepal occurs in spring so these activities will be reported in the CSISA annual report.

SUSTAINABLE WHEAT INTENSIFICATION AT SCALE

- **Introduction of elite wheat varieties:** CSISA has introduced six different elite wheat varieties suitable for early seeding and evaluated them under on-farm and on-station conditions in collaboration with the National Wheat Research Program and seed companies during the 2017–18 wheat season. Borlaug 100, the most promising new line from CIMMYT, is resistant to wheat blast and also comparatively rich in zinc and iron. Top-performing wheat varieties will be further evaluated and multiplied through seed companies for commercialization.
- CSISA conducted a **household and crop-cut survey** in the mid- and far western Terai to determine attainable and potential yields and profit gaps under farmers' conditions. The results showed attainable and potential yield gaps of 1.3 t/ha and 4.5 t/ha, respectively, with an attainable profit gap of US\$ 360/ha. These results were communicated to public and private stakeholders in the wheat sector.
- The government-implemented Wheat Super Zone program used their own funds to print and disseminate **9,000 'tips for wheat intensification'** developed by CSISA and the National Wheat Research Program.

PRECISION NUTRIENT MANAGEMENT

- In the Feed the Future districts only 13% of farmers are applying **potassium fertilizer** with a very low rate being applied to wheat fields. CSISA continued to communicate the importance of balanced fertilization for increasing crop yield and improving soil health by conducting trainings, on-farm demonstrations, and distributing factsheets. CSISA is trying to capitalize on increasing sales for potassium fertilizer through the Agriculture Input Company Limited, where 28.6 t were sold in 2015 and 51.05 t were sold in 2017.
- CSISA conducted awareness-raising and market facilitation activities to continue incentivizing uptake of the **precision spreader**, a simple low-cost tool that significantly increases fertilizer use efficiency. To date, more than 2,000 precision spreaders have been sold in Nepal. The first commercial spreaders were introduced into Nepal by CSISA in 2016.
- To understand users' perceptions of the precision spreader, CSISA conducted a **survey of 80 spreader users across the six western Terai districts**. Most of the users reported that the spreader is less hazardous for humans, easier to operate, reduces drudgery, saves cost, facilitates the uniform spread of seed and fertilizer, and increases yields compared to manual broadcasting.

OBJECTIVE 1: STRENGTHENED SEED SYSTEMS

Enabling Nepali farmers to adopt improved crop varieties is considered fundamental to raising productivity and developing greater resilience to biotic and abiotic stresses. This is because rain fed subsistence farming is common and seed replacement rates of major cereal crops is quite low (around 11%). The national seed industry is at a nascent stage and most of the crop varieties are obsolete, and farmers are also not aware of the economic benefits of varietal replacement. CSISA has worked to develop robust seed systems for cereals and legumes by enhancing the technical and business management capacities of seed enterprises to make them technically stronger, market-oriented, professionally organized, and strategically linked with various actors along the value chain.

To address the aforementioned challenges and opportunities, CSISA adopted a public–private partnership approach to strengthen the capacity of stakeholders involved in wheat, maize and pulse (i.e., lentil and mungbean) value chains. These stakeholders include seed companies, dealers, producer groups, cooperatives, research and development organizations and development partners. CSISA is facilitating the partners to close knowledge gaps about the yield performance of lentil and mungbean, wheat cultivars and registered maize hybrids, through networks of community-based evaluations that provide crucial science-led insights and generate demand for seed companies, dealers, and among farmer-clients for these businesses. For mungbean, evaluations have been co-sponsored by seed companies, the Department of Agriculture, and the Nepal Agricultural Research Council.

Input dealers stock and market registered maize hybrids

The maize season in Nepal occurs during April–June, so these updates will be provided in the CSISA annual report.

Private seed companies expand businesses for wheat and pulses

Since 2014, CSISA has provided mentoring support to emerging Nepali seed companies for business planning, technical guidance and market development.

Company-led market development: To generate demand among farmers, four of the top performing and most proactive companies (GATE Nepal, Panchashakti, Unique, and Lumbini), mentored by CSISA, implemented field demonstrations of recently released and pipeline wheat varieties in collaboration with seed producers' groups in new areas using the companies' own resources and initiative.

During the 2017–18 wheat season, the four companies conducted more than 50 demonstrations, including of the varieties Banganga, NL 971, Sworgadwari, Munal, Cyakhura, and BL 4341 in new areas where those varieties have not yet been adopted at scale.

Company-led market development: Feedback from the seed companies

Large plot demonstrations of new and pipeline varieties under best management practices were implemented by four seed companies in collaboration with seed producers' groups. These demonstrations were helpful for generating demand among farmers for new varieties. Mr. Laxmi Kant Dhakal, president of the Seed Entrepreneurs' Association Nepal and proprietor of Unique Seed Company, explained that such initiatives have increased confidence among seed company personnel and seed growers to increase the volume of new varieties as the demand for those varieties has increased significantly. Seed producer-farmers have learned best management practices so the quality of seed has also improved. This type of initiative will help speed up the dissemination of high-performing varieties at scale.

The seed companies estimated that about **4,000 households visited these demonstrations during the growing season, and about 10 tons of seed will be collected** from the demonstration for next year’s planting.

Technical advances: Following technical trainings, the aforementioned companies started maintenance breeding for wheat in 2016 to enhance the quality of source seed used for ‘truthfully labeled’ seed production. Building markets in regions like Nepal where farmers do not regularly purchase seed is a challenge. Maintenance breeding helps maintain seed quality and therefore develop trust among farmers that they are purchasing a reliable product, worth their investment.

The varieties undergoing maintenance breeding are recently released varieties, pipeline varieties, and a variety called Borlaug 100. Borlaug 100 is from Mexico, introduced by CIMMYT in 2016 in coordination with the National Wheat Research Program in response to the emerging threat of wheat blast in South Asia. In addition to resilience traits, four of the newer wheat varieties prioritized for the Nepal market are comparatively rich in iron and zinc. Wheat harvesting is currently going on, however from preliminary information it can be estimated that seed companies will produce around nine tons of source seeds from maintenance breeding operations for next season. Using the participatory variety selection (PVS) trials carried out by seed companies in farmers’ fields and on NARC research stations, the National Wheat Research Program is preparing to submit a proposal for the release of wheat variety BL 4341.

Financing for growth: A core component of CSISA’s mentoring efforts for companies has been the creation of business plans that are based on a vision for growth that is specific to each company. Having a convincing business plan is an important component of securing financing to drive expansion, and the companies supported by CSISA have tapped into loan programs funded by the International Fund for Agricultural Development and the Asian Development Bank. These sources of capital have allowed the 11 seed companies to expand their facilities to include seed storage buildings, processing plants and laboratories. CSISA is also working to facilitate commercial lending between the companies and banks that are backed by USAID’s Development Credit Authority as part of the Nepal Seed and Fertilizer program, which is also implemented by CIMMYT with support from USAID-Nepal.

Accelerating seed sales: The rapid growth of seed sold to farmers by our private sector partners is strong evidence that CSISA is contributing to the emergence of strong, sustainable, and market-oriented seed systems in Nepal. Since the base year of 2014, prior to the inception of CSISA-Nepal Scaling, wheat seed sales volumes of the two major seed companies (Unique and Lumbini) in particular, as well as the total seed from the four major seed companies that CSISA is working with in general, have increased significantly. Over a three-year period the total volume of seed sold by the four most ambitious companies increased by 400% (Figure 1) suggesting an increase of 4,300 hectares planted in



FIGURE 1. SEED SOLD VOLUME BY SEED COMPANIES OVER A 4-YEAR PERIOD

newer wheat varieties and quality seed in 2017. Harvesting is currently going on, so seed produced for 2018 by the major seed companies will be included in the next annual report.

Replacing old varieties with newly released ones

CSISA’s household survey results showed that 45% of farmers are using old varieties highly susceptible to pests and diseases. CSISA is contributing to the emergence of strong, sustainable, and market-oriented seed systems by strengthening the capacity of the Seed Entrepreneurs’ Association of Nepal (SEAN). CSISA is working with the four largest seed companies – Unique, Panchashakti, Lumbini, and GATE Nepal – to increase the share of newly released varieties that are replacing old

ones. For example NL-297, a 35-year old variety, occupied the largest share (35%) of seed production in 2014, but declined to 19% in 2017 (Figure 2). Nepalese seed companies have now started to produce seed for recently released and pipeline varieties in collaboration with seed producers' groups.

Strategic investments and enhanced coordination among seed system actors

Linkages to policy innovations and development programs:

At the invitation of our government partners, CSISA participated in three key strategy meetings: Seed Vision Review, Regional Seed Balance Sheet Development, and Orientation for Zone and Super Zone Leaders under the Prime Minister's Agriculture Modernization Project (PMAMP). In these platforms, CSISA shared information about opportunities for scaling new wheat, maize, and legume varieties, as well as information on inclusive business models for reaching relatively poor farmers.

PMAMP is envisioned as a 10-year, US\$ 100 m investment, and strategic coordination with this program is a top priority for CSISA. CSISA organized a national-level rice, wheat, maize, and mechanization thematic working group meeting in partnership with PMAMP, and detailed action plans have been developed. This initiative has been useful not only in institutionalizing CSISA's innovations and findings but also in designing approaches that are market-oriented among our private sector partners.

CSISA also helped strengthen the Seed Entrepreneurs' Association of Nepal and National Seed Producers' Association by updating their vision for government engagement and improving the types of services provided to members. Consequently, the associations jointly requested the government to withdraw existing seed subsidies that do not facilitate the development of markets for new elite varieties. In response, the Ministry of Agricultural Development formed a three-member committee composed of SEAN, Seed Quality Control Center (SQCC) and District Agriculture Development Offices to make recommendations for potential seed subsidy revisions. Encouragingly, the subsidy for NL 297, a 35-year-old wheat variety, was removed at the request of SEAN and SQCC.

Looking forward

A variety of key activities started through CSISA-Nepal Scaling's seed systems objective have a high potential for being carried forward by partners or other donor-funded projects, as evidenced by examples provided below.

Strategic government partnerships: The Prime Minister's Agriculture Modernization Project focuses on the same core cereal crops that CSISA works on – wheat, maize and rice – and has the resources and the reach to support crop production at scale. CSISA has already collaborated with PMAMP to start thematic working groups for rice, wheat, maize and mechanization, and in partnership they developed action plans for the 2017–18 cropping seasons. With continued technical backstopping and support on seasonal work plan development from CSISA, PMAMP can carry forward agronomic interventions for cereal cropping systems in CSISA's working domain.

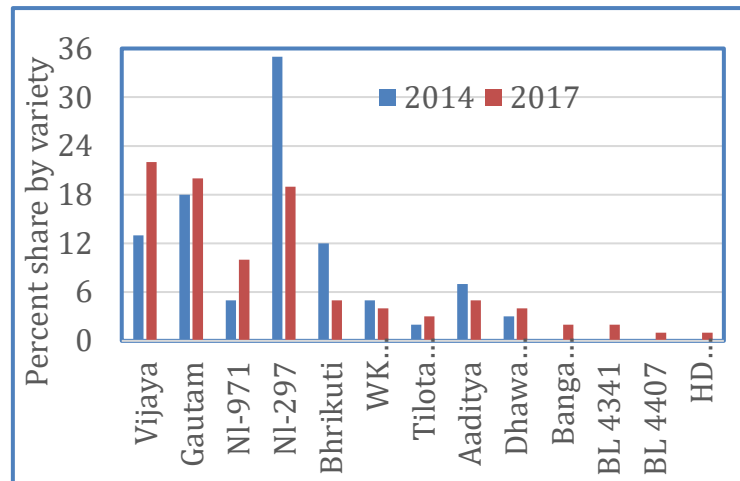


FIGURE 2. PERCENT SHARE OF SEED OF DIFFERENT VARIETIES PRODUCED BY THE FOUR LARGEST SEED COMPANIES IN 2014 AND 2017 IN WESTERN TERAI, NEPAL

OBJECTIVE 2: SUSTAINABLE LENTIL AND MUNGBEAN INTENSIFICATION AT SCALE

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 – especially *Stemphylium*, a fungal disease that can cause total crop failure in high rainfall years. Survey data suggests that more than 60% of lentil-growing farmers in the FtF Zone incur financial losses from lentil cultivation in such years. Also, simulation results using long-term weather data from the western Terai suggest that more than 73% of all years are expected to have high disease severity resulting in significant productivity losses.

Can better genetics reduce risks to lentil cultivation?

Since 2015 CSISA has been collaborating with the National Grain Legume Research Program (NGLRP), and ICARDA to evaluate 100 lentil genotypes from the Mediterranean region for broad-adaptability to drought and excess moisture conditions. Among the genotypes tested, five lines were observed to be resilient to drought in a year without winter rainfall. Out of those five lines, three lines performed well in the ‘normal’ rainfall conditions observed in 2016–17. With the current uncertainty of CSISA funding, NGLRP is continuing to further evaluate those lines under dry and wet conditions using their own resources. Registration and commercialization processes of those lines are underway.

Stakeholders meeting on lessons learned for lentil production in Nepal

CSISA organized a meeting to facilitate the sharing of lessons learned on lentil cultivation in October 2017 in Kathmandu. Major stakeholders working on lentil production (USAID-Nepal, National Grain Legume Research Program, and two USAID-funded projects: Nepal Seed and Fertilizer (NSAF) and Knowledge-Based Integrated Sustainable Agriculture in Nepal (KISAN II) participated in the meeting. The meeting provided information essential to establishing research and development priorities and action plans for combatting the primary threats to lentil production in Nepal. Also, CSISA shared a disease management guideline jointly developed with NGLRP in 2016 that could reach a large number of farmers through the KISAN and NSAF networks.



STAKEHOLDERS' MEETING FOR SHARING KNOWLEDGE AND LESSONS LEARNED



TIPS FOR STEMPHYLIUM BLIGHT DISEASE MANAGEMENT IN LENTIL

Building coalitions for lentil intensification

Lentil stemphylium blight disease, caused by *Stemphylium botryosum*, is threatening to undermine sustainable lentil production in Nepal. Research conducted in different regions showed that yield loss due to stemphylium blight is up to 100% depending on disease severity. Disease severity varies significantly across years and locations. In this context, CSISA is collaborating with the USAID-funded Climate Services for Resilient Development (CSR) and the National Grain Legume Research Program

on a lentil stemphylium disease monitoring study across the mid- and far- western Terai districts. This study will be helpful for predicting the onset and severity of stemphylium disease in lentil, while considering climate and management factors. The outcome of this study will be shared at the national level to help facilitate the development of a strategic plan for improving disease management and lentil intensification in Nepal.



IN-FIELD DISEASE SCORING TRAINING FOR LENTIL TO THE FIELD TECHNICIANS

Mungbean

Expanding mungbean cultivation through market facilitation

As a short-duration crop that can be cultivated during the hot ‘summer’ period before the arrival of monsoon rains, mungbean can be cultivated without displacing existing crops while generating significant economic, nutritional and soil health benefits. Since 2015, CSISA has played an active role in commercializing mungbean production in the FtF zones through the development of market-oriented public–private partnerships. CSISA’s major role in this process included: facilitating contractual arrangements between the seed companies and agriculture 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.

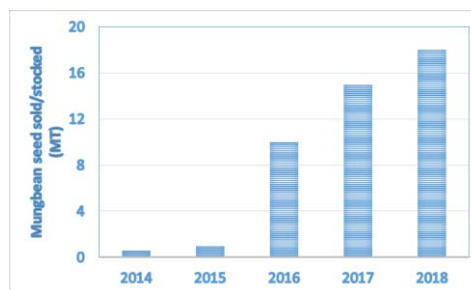


FIGURE 3. TRENDS OF MUNGBEAN SEED SOLD/ STOCKED IN MFT DISTRICTS

Mungbean cultivation has increased significantly over the years (Figure 3) and the government has prioritized mungbean as a green manure crop, providing subsidy for seed and irrigation costs to encourage farmers to take up mungbean cultivation. Prior to CSISA’s efforts, this low risk and high return pulse crop was not cultivated at scale in the FtF Zone of Nepal. Mungbean seeding has just started, details on number of adopter farmers and area coverage will be reported in the forthcoming annual report. However, it is important to note that due to funding uncertainty CSISA has reduced its direct involvement in promoting mungbean in new areas.

OBJECTIVE 3: SUSTAINABLE WHEAT INTENSIFICATION AT SCALE

Wheat is the third most important crop staple in Nepal, following rice and maize. In the Terai, where production is concentrated, 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 to better cope with 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.

Domain-specific recommendations for management practices that will enable early wheat establishment

Introduction of elite wheat varieties suitable early seeding from Eastern UP, India

Most of the released wheat varieties available in Nepal fall within the same medium duration (130–135 days) maturity class. Studies conducted by CSISA in India have demonstrated that long-duration wheat varieties have significantly enhanced yield potential for timely planting together with no yield penalty compared to shorter duration varieties with later planting – i.e. broad adaptability, which is a very important trait since many farmers do not know when they will be able to plant in any given year. CSISA-Nepal collaborated with CSISA-India to bring in six promising wheat varieties of different maturity durations. Those varieties were evaluated in on-station trials in collaboration with the National Wheat Research Program and on-farm in collaboration with two the Unique and Lumbini seed companies. The studies included a check composed of some Nepali varieties. The evaluation plots were visited by different scientists from NARC and the Department of Agriculture as well as farmers' groups. In the initial evaluation, varieties HD-2767, HD-2967, and HD 2824 seem promising for early seeding over the check. Crop harvesting is currently underway, and detailed outcomes of the evaluation will be presented in next annual report.

Social marketing approaches utilized to 'get the word out' on the importance of early planting

See below on strengthened collaborations with government partners like PMAMP to mainstream methods and messages.

Wheat crop cut and production practice survey

To capture changes in management practices and to estimate benefits of technology adoption, a 'crop cut and production practices' survey was conducted in April 2017, after wheat harvest and high-level insights from advanced analyses were produced during this reporting period. The survey was intended, in part, to capture changes in management practices associated with CSISA interventions, including our social marketing campaigns such as radio jingling on the importance of early wheat sowing, increasing irrigation when winter rains are absent, and gains in yield potential that can be achieved by planting longer duration varieties.

For the survey, we used remote sensing data to develop a representative sampling scheme that captures gradients in wheat productivity levels at the regional scale. The survey was developed in Open Data Kit (ODK) and deployed via smart phones.

From this survey we also derived the attainable and potential yield gaps for six FtF Terai districts and one non-FtF major wheat-growing district, Rupandehi. It was found that the average attainable yield gap (difference between top 10th percentile mean and population mean) ranges from 1.2 to 1.5 t/ha and the climatic potential yield gap (difference between climatic potential yield and population

mean) ranges from 4.4 to 4.9 t/ha (Figure 4). The top performing farmers have applied more fertilizers and/or balanced fertilizers, more irrigations and also participated in trainings.

Similarly, the net profit of the individual wheat growing farmers were calculated from the total production cost and total income from grain and straw. In the surveyed region, the average profit gap in wheat production is US\$ 360/ha (difference between top 10th percentile and population mean). Moreover, 11% of farmers are in loss from wheat production and around 20% of farmers are earning a net profit of less than US\$ 100/ha (Figure 5). These results showed that there is ample opportunity for closing the yield and profit gaps through better agronomic practices for sustainable wheat intensification in the region. These outputs were communicated to different wheat sector public and private partners including the government-led Wheat Super Zone program.

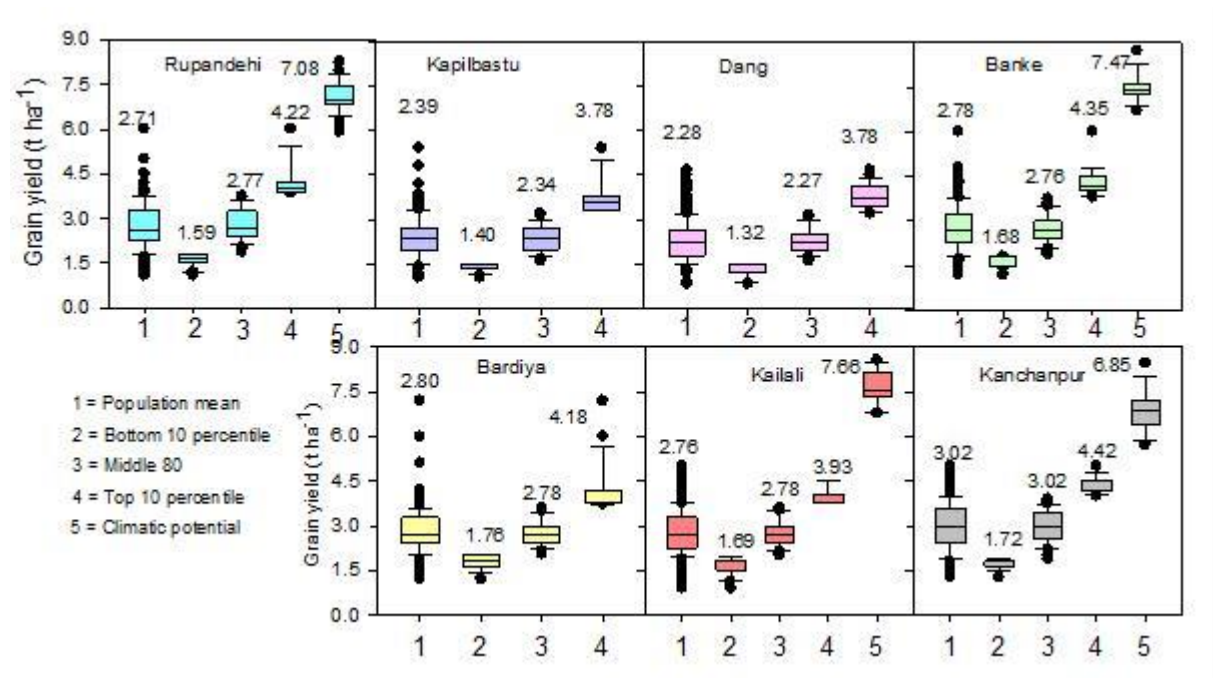


FIGURE 4. ATTAINABLE AND CLIMATIC POTENTIAL YIELD GAP IN WHEAT IN DIFFERENT DISTRICTS OF NEPAL

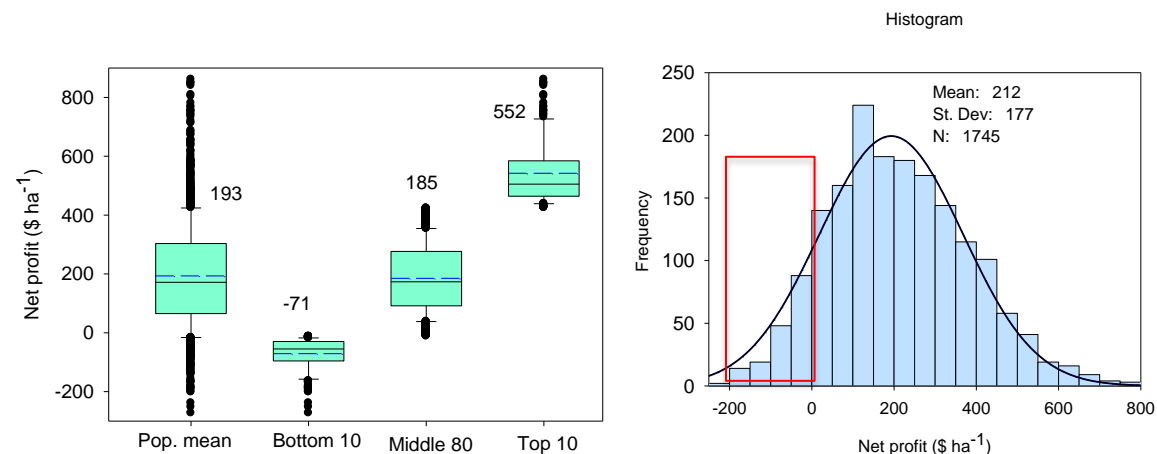


FIGURE 5. ATTAINABLE PROFIT GAP (A) AND DISTRIBUTION OF NET PROFIT (B) OF THE WHEAT PRODUCING FARM IN THE SURVEYED REGION

Partnering with the Nepal government to guide new investments for wheat intensification

In 2016, the Government of Nepal endorsed a new 20-year agriculture development strategy that charts a progressive course of action to revitalize agriculture as an engine for economic growth and domestic food security. At the center of this strategy is the Prime Minister's Agriculture Modernization Project. The project will be implemented over the next decade and has research and development mandates for productivity enhancement and commercialization of major cereals, fisheries, fruits and vegetables.



PMAMP emphasizes wheat production in the western Terai region as a food security priority and endeavors to achieve national self-sufficiency in wheat within the next three years. Meeting this extremely ambitious goal will require an unprecedented increase in average yields of 10% per year, and necessitates a high level of strategic coordination among organizations contributing to agricultural development in Nepal. PMAMP has recognized CSISA as a technical advisor and strategic partner to design and implement programs for staple crop production, including mechanization and seed systems. Going forward, **CSISA sees the PMAMP as a key mechanism for scaling up sustainable intensification technologies in Nepal.**

Following up on the work plan jointly developed by wheat sector stakeholders in the national wheat forum meeting organized by CSISA and PMAMP in July 2017, CSISA provided technical guidance to the Wheat Super Zone program for implementing the action plan for 2017–18. Despite uncertainty in funding, CSISA continued to support the Wheat Super Zone in following areas:

- Trainings-of-trainers for the Wheat Super Zone technical staff and operational committee members on best management practices for wheat. Examples include the importance of better crop establishment methods, balanced fertilizer management, weed and water management, and mechanized harvesting.
- Technical support for organizing zero tillage (ZT) wheat demonstrations in new areas
- Cross-border visit for key farmers, service providers, and Super Zone technical staff to CSISA India's sites in Gorakhpur in Eastern Uttar Pradesh, where they interacted with CSISA-India scientists and staff. The interactions served as a good learning platform for the attendees.
- Technical support for developing extension messages
- Technical guidance for developing on-farm research protocols, especially on crop establishment methods and integrated weed management
- Market facilitation by linking machinery importers with local traders for the timely supply of appropriate machinery.

Social marketing through established and emerging communications channels

Collaborations with development partners: In collaboration with the National Wheat Research Program, CSISA developed factsheets for better-bet agronomy for wheat from seeding to harvesting to storage based on research outcomes from different areas. **Six thousand factsheets were already deployed prior to the start of the 2015–16 and 2016–17 wheat season** through public and private partners such as District Agriculture Development offices, Improved Seed for Farmers project (KUBK), KISAN, and NIMBUS. Seeing its importance and usefulness to the technicians and farmers the government-implemented PMAMP project (i.e. Wheat Super Zone) has printed and

disseminated 9,000 factsheets of different types (2,000 of ZT wheat, 2,000 of fertilizer management, 3,000 of weed management, 2,000 of best management practices) using their own resources during the 2017–18 wheat season. Key messages, including the importance of irrigation, fertilizer and weed management, were also broadcast through local FM radio in the Wheat Super Zone command area in different local languages during the 2017–18 wheat season.

Building a service economy for zero tillage wheat

Zero tillage can facilitate timely sowing while also reducing crop establishment costs, but is a completely new technology in the FtF Zone. Initially, CSISA began a market development collaboration for zero-till drills and planters with The Habi, a 4-wheel tractor trader. The Habi, with CSISA backstopping, began marketing zero-till drills from National Agro Industries (Ludhiana, India) during the 2014–15 wheat season. CSISA supported by providing technical training for service providers on how to calibrate and operate ZT seed drills.

CSISA continued to monitor the market for 4-wheel tractor seeders and noted that prices of The Habi’s machines remained high and that the company was not following through with its marketing strategy that should have included farmer field days, adding new sales outlets and pursuing competitive pricing. To increase the wider availability of zero-till seed drills the market and to drive down prices, CSISA began to facilitate business tie-ups with other Indian manufacturers (linking India’s Khedut Agro and Dharti Agro with Nepal’s BTL and Kubier and Sons) and even facilitated China’s first four-wheel tractor seed drill entry into Nepal with an innovative maize planter that uses a precision vertical plate seed meter.

Sales were also bolstered by CSISA’s government partners, Department of Agriculture’s (DoA) Directorate of Agricultural Engineering, NARC, and most recently the PMAMP “buying into” the technology and starting their own promotion activities, including subsidies from DoA, with stronger links forged with the private sector so that markets and repair networks are also emerging to support the sustained spread of the technology.

CSISA has also aired radio jingles on local FM radio stations about the benefits ZT along with contact information for service providers. At the dealer level, CSISA has placed additional of four-wheel tractor ZT drills and two-wheel tractor reduced till drills in machinery showrooms on a consignment basis so that market availability increases in areas in the Feed the Future Zone where machinery retail networks are comparatively weak. CSISA also facilitated the establishment of two machinery-hiring centers in Bardiya, which are providing different machinery-based services, including ZT wheat, on a custom-hire basis.

With technical and market development support from CSISA, more than 200 service providers purchased seed drills across the Terai by the end of 2017. A recently conducted survey in four Terai districts (Banke, Bardiya, Kailali and Kanchanpur) showed that in the 2017–18 wheat season, service providers seeded wheat on more than 700 ha, benefiting around 1,545 households.

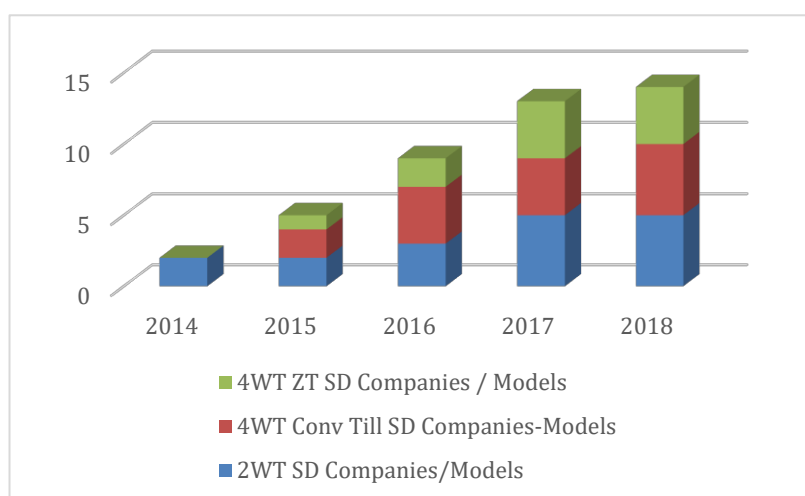


FIGURE 6. SEED DRILL MODELS AND COMPANIES COMMERCIALY AVAILABLE IN NEPAL

The increasing number of importers and seed drill models shown in Figure 6 and the increasing sales of seed drills in the FtF Zone in Figure 7 indicates a close correlation of the increasing number of private sector importers with overall sales. There were no four-wheel tractor seed drill importers until CSISA made the first linkage between National Agro and The Habi in 2013. Prior to that, the few four-wheel tractor drills in country came through projects and other non-market channels. In the last two years, annual drill sales have increased significantly, indicating signs of a maturing market for 2-wheel and 4-wheel tractor seed drills and planters.

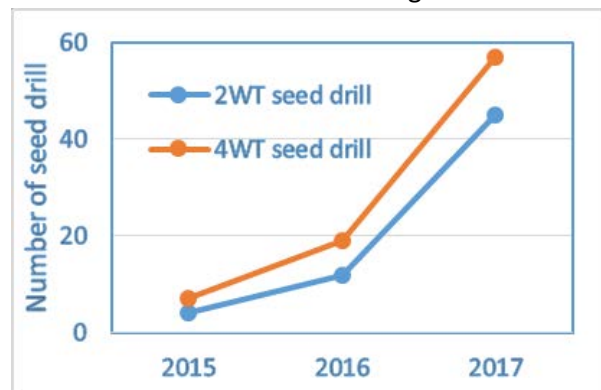


FIGURE 7. NUMBERS OF SEED DRILLS AND PLANTERS SOLD IN NEPAL'S MID AND FAR WEST REGIONS

Another clear change is in the emerging collaborations between private sector machinery suppliers and government partners like District Agriculture Development Offices and PMAMP, where the private sector is providing demonstrations and training at government events. Seeing the benefits of ZT wheat, as well as rising demand from farmers, most of the District Agriculture Development offices and the PMAMP wheat super zone program have included ZT wheat technology in their own programs.

CSISA has also developed business-to-business linkages in which private Nepalese seed companies, in an attempt to improve their seed growers' yields and quality, have invited private machinery suppliers for demonstrations and trainings given to their seed growers. **CSISA has not only played a market facilitation role by linking machinery importers with local traders but also public-private and business-to-business partnerships that further sustain the markets for agricultural mechanization and conservation agriculture technologies.**



ZERO TILLAGE WHEAT ESTABLISHMENT

Yet, even as the sales markets continue to grow, work remains as CSISA has found that the 'use rates' of both the two-wheel and four-wheel tractor seeders and planters are low -- with two-wheel tractor seeders averaging under 3 ha per season and four-wheel tractor seeders averaging under 15 ha per season. In both cases the potential is 3 to 4 times this use rate. CSISA will continue to strive to understand the emerging seed drill service markets, their constraints, and ways to strengthen them.

OBJECTIVE 4: PRECISION NUTRIENT MANAGEMENT AT SCALE

In Nepal, fertilizer use is far below the state recommendation for all staple crops. Also, 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.

Domain- and-situation specific soil fertility management strategies developed for wheat, lentil and maize

CSISA staff were instrumental in securing funding for the USAID mission-supported ‘Nepal Seed and Fertilizer (NSAF) project. Our staff helped design and implement strategic soil fertility management field trials for wheat, rice, lentil, and maize that were implemented in 2017. Leadership of this research stream has now been handed over to NSAF staff.

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

A household survey conducted for rice and wheat in the Feed the Future zone showed under-fertilization and imbalanced application are major reasons for low crop productivity in Nepal. On average, farmers apply nitrogen and phosphorus fertilizer at rates less than 50% of the national recommendations. Only 13% of farmers apply potassium.

Several on-farm and on-station experiments conducted in collaboration with the National Wheat Research Program and farmers’ groups for different production environments showed that wheat yields can be doubled through balanced fertilizer application. CSISA continued to communicate research findings in coordination with the Nepal Seed and Fertilizer project, the government-led zones and super zone programs, seed companies, farmers’ co-operatives and through trainings to District Agriculture Development Offices. Communicating the importance of fertilizer management through co-operatives is the most effective pathway as these entities also supply fertilizer to farmers in their command areas.

CSISA also developed posters showing the importance of fertilizer and placed them in co-operatives. Partially because of CSISA’s efforts, technicians and farmers are well sensitized to the importance of balanced fertilizer application. This is reflected in increased demand for potassium fertilizer, as well as the rising number of co-operatives stocking it, since they previously only sold urea and DAP fertilizer. For example, sales of potassium fertilizer by the Agriculture Input Company Limited, Tulsipur, Dang, increased significantly where sales were 28.6 t in 2015 and reached to 51.05 t in 2017 (Figure 8), while sales were similar across years for urea and DAP fertilizer.

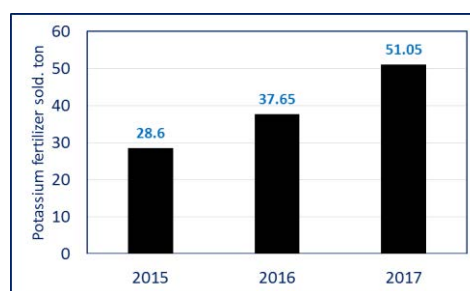


FIGURE 8. TREND OF POTASSIUM FERTILIZER SOLD BY AGR. INPUT COMPANY LIMITED, TULSIPUR, DANG.

Policy-level initiatives

As a result of collaborative research conducted with CSISA, 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. 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.

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

Low-cost spreaders efficiently bring precision management to smallholders

The hand broadcasting of seed and fertilizer is common in Nepal and results in patchy distribution and inefficient uptake of nutrients by plants, leading to a significant reduction in crop yields compared to those achievable under better management. To minimize the variability associated with hand broadcasting, CSISA introduced mechanical seed and fertilizer spreaders into its working domains in Nepal in 2014. Mechanical spreaders can be used for broadcasting seed such as rice, wheat, lentil, mungbean and granular fertilizer such as urea and DAP. Research shows that the use of a **precision spreader improves yields by 7–10% and generates 50% savings in labor costs and time involved for fertilizer application.**



Users' perception on precision spreader

In Nepal, farmer adoption of new agricultural technologies can be very slow. To facilitate the adoption of spreaders, CSISA has worked with manufacturers, importers, local distributors, District Agriculture Development Offices, farmers' cooperatives, USAID-funded projects such as KISAN and Nepal Seed and Fertilizer project and seed companies to evaluate and facilitate the testing and uptake of these compact tools.

To understand users' perceptions of the precision spreader, CSISA conducted a survey of 80 farmers across six Terai districts on the use of the precision spreader. More than 90% of these users reported that the spreader is easier to operate, reduces drudgery, saves costs, and facilitates uniform spreading of seed and fertilizer compared to manual broadcasting (Figures 9). CSISA also asked users about problems with the spreader. Thirty-five percent of farmers reported that they had no problems with using the spreader, while 22% of farmers reported problems with calibration to adjust the seed and fertilizer rates, 13% of farmers reported the seed and fertilizer holding bag is too small in the currently available unit, 10% of farmers reported the machine is only useful for granular fertilizer (not seed), and another 10% reporting higher dropping rates (of seed fertilizer) at the start. The outcomes of the survey will be communicated to different public and private stakeholders including the manufacturers for generating awareness about the spreader and for further improvement of the machine.

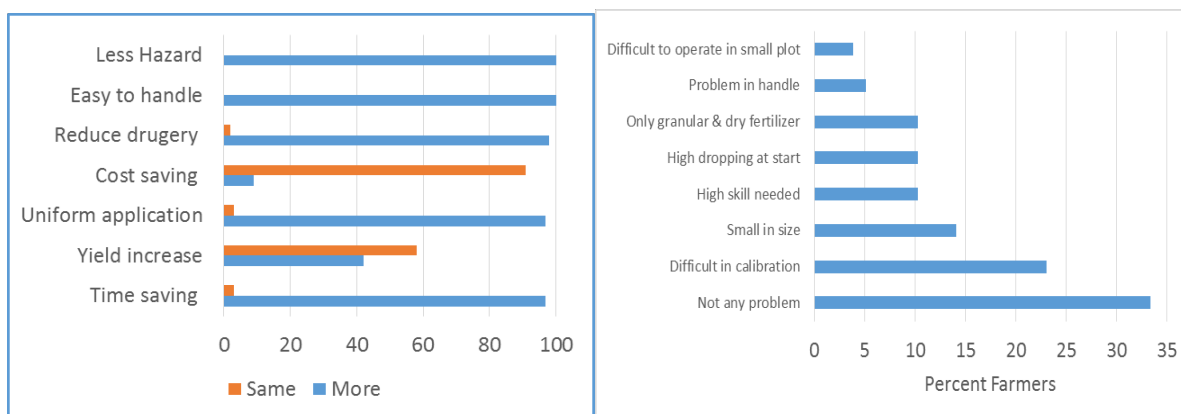


FIGURE 9. USERS' PERCEPTIONS OF (A) USING PRECISION SPREADERS FOR SEED AND FERTILIZER BROADCASTING COMPARED TO HAND BROADCASTING AND (B) PROBLEMS ASSOCIATED WITH THE PRECISION SPREADER

Since 2014, CSISA has also provided training to cooperatives, extension personnel and agro vet technicians to help facilitate the uptake of spreaders across a wide geography. To date, **CSISA has trained more than 250 service providers, over 1,300 farmers, and more than 250 agricultural technicians from the public and private sectors.** In 2015, CSISA produced a user-friendly guide for the precision spreader, covering handling guidelines for both seed and fertilizer broadcasting. These guides were distributed to farmers' co-operatives, agro vets, other USAID-funded projects, District Agriculture Development Offices, and the government-led Prime Minister's Agriculture Modernization Project, all of which are interested in supporting the deployment of precision spreaders. Also, the guidelines were adopted by the major importers – SK Traders and BTL Traders – printed them at their own cost and supplied them with every spreader sold.

Given the high level of farmer acceptance and the identification of a low-cost regional manufacturer, three major importers – SK Traders, AMC and BTL Traders – have started importing and selling precision spreaders through more than 20 dealers across the country. **To date, more than 2,000 units have been imported and sold commercially. Traders have also placed an order for > 1,200 more units. If used for spreading wheat and lentil seed, this quantity has the potential to cover more than 4,000 ha in a season.** In 2017–18, many of the District Agriculture Development Offices in the Terai have included the precision spreader in their machinery subsidy programs, allowing farmers to procure the equipment at a reduced price from local suppliers.

CSISA is optimistic about market-led expansion precision spreading technology in Nepal due to the initial support that the technology enjoys across the value chain. The increasing number of importers and dealers selling the spreaders at the local level signals that the private sector sees value in the technology and expects a robust market to emerge. DADOs embedding precision spreaders into their subsidy schemes reflects local public-sector responsiveness to farmer demand, and farmers procuring the technology shows that farmers believe the technology will be remunerative, despite the initial investment cost. The sustainable intensification of cereal systems in Nepal will, indeed, depend on farmers adopting affordable, scale-appropriate technologies such as precision spreaders to generate higher yields from small landholdings in the face of labor constraints common in Nepal's agricultural areas.

Key challenges faced during the reporting period

Evolving process of political devolution:

- Nepal recently entered in the complicated effort of building a federated structure with more regional autonomy. One result is that the agricultural budget that used to be with the District Agriculture Development Offices has been diverted to new, local administrative units. As there is no clear-cut breakdown of local budget by sector, many agricultural development support programs have been deferred or otherwise delayed.
- Also, many of the district level DADO staff as well as offices have been shifted to provincial government control. While this devolution is likely to be beneficial in the long-term, the system as a whole is facing 'growing pains' as new institutional and staffing arrangements emerge.
- These changes have temporarily disrupted CSISA's partnerships at the national and local levels.

Funding uncertainty

- In September 2017, it became clear that FY18 funds for this project were expected to be delayed, greatly reduced and/or zeroed out.
- At reporting time, seven months into FY18, funding has neither been confirmed nor disbursed, limiting our ability to make commitments to staff and/or partners.
- In response to funding uncertainty and delays, CSISA has had to reduce its staff strength by around 75% as we conserve funds. Without clarity on additional funding, we will be unable to further renew additional staff contracts.

Engagement with Missions, FTF partners and project sub-contractors

USAID Missions

CSISA engaged with the Nepal mission in the following core areas in FY18:

- Provided technical advice and support to the KISAN II project (USAID-Nepal's flagship FTF program) on staple crop management.
- Shared technical insights into challenges and opportunities confronting the sustainable intensification of lentil production in Nepal to the USAID-funded projects, i.e., 'Nepal Seed and Fertilizer' (NSAF) and KISAN II.

FTF partners

In Nepal, the KISAN II project, part of USAID's global Feed the Future initiative, is a \$20 million five-year program working to advance food security objectives by increasing agricultural productivity. KISAN II 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 II has a reach of hundreds of thousands of farmers, who have been exposed to CSISA information, materials, and technologies through this partnership.

CSISA and KISAN II have:

- Produced accessible guides for **better bet agronomy for rice and maize** – information that is generally not available to smallholders. KISAN has reproduced these guides with their own resources and they provide the backbone of their

technical training programs for maize and rice, the two core staple crop value chains for the project.

- Developed a factsheet on *Stemphylium* management for lentil and provided training to technicians from DADOs, KISAN, seed companies and some key farmers in different districts with the objective to disseminate the information to additional farmers

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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Scott Justice	Obj 5 Theme Leader	CIMMYT	Kathmandu, Nepal	9851027678	s.justice@cgiar.org
Gokul Paudel	Socio-economist	CIMMYT	Kathmandu, Nepal	9845089438	g.paudel@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+ years
Nepal Seed and Fertilizer Project (NSAF) -USAID	Strategic partnership to co-support on the large scale deployment of extension information and technologies	Achieving impact at scale	USAID-Nepal funded NSAF (Nepal Seed and Fertilizer, \$15 m from 2016–2021) project, an initiative with a focus that spans the applied science-to-development continuum, inclusive of market facilitation efforts to expand private sector-led fertilizer sales. CSISA is taking advantage to disseminate the better-bet technology at scale through the NSAF networking	New
Building Resilience and Adaptation to Climate Extremes and Disaster (BRACED)-DFID	Opportunistic partnership to take advantage of value chains, entrepreneurial skills and collections centers created by BRACED partners	Achieving impact at scale	DFID-UK funded BRACED project prioritizes ‘Developing Climate Resilient Livelihoods for local communities through public-private partnership for 500,000 poor people in western Nepal that suffer from climate extremes and disasters’. CSISA is taking advantage to disseminate the better-bet technology, farm mechanization at scale through the BRACED networking	Active for 2+ years
Seed For Farmer Project (KUBK) - IFAD	Opportunistic partnership to take advantage of their	Achieving impact at	IFAD-funded Government led seed project with the objective to Support Extension of the Formal Seed	New

	net-working for the dissemination of appropriate farm mechanization and best bet technologies	scale	Sector and Entrepreneurship and Institutional Development. CSISA is taking advantage to disseminate the better-bet technology, strengthening seed systems at scale through their networking	
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Appendix 3: CSISA-Nepal Scaling and the GFSA

Global Food Security Act Goal: Sustainably reduce global hunger, malnutrition, and poverty

GFSA Objective 1

Inclusive and sustainable agricultural-led economic growth

Seed systems: Input dealers stock registered **maize hybrids**

Seed systems: Private seed companies expand businesses for **wheat and pulses**

Seed systems: Strategic investments & **enhanced coordination** among seed system actors

Pulses: New **low-risk opportunity crops** promoted by government and private sector, along with economic and nutritional messaging

Wheat: **Domain-specific recommendations** for management practices that will enable early wheat establishment

Wheat: **Social marketing** approaches utilized to 'get the word out' on better-bet agronomy for wheat

Precision Nutrient Management: Domain- and situation-specific **soil fertility management strategies** developed for wheat, lentil and maize

Precision Nutrient Management: **Broad-scale awareness** of the yield and economic benefits of judicious fertilizer application

Mechanization and Irrigation: Appropriate technologies for overcoming energy and cost bottlenecks to **irrigation expansion** identified

Mechanization and Irrigation: Identification of physical and operational models of **land aggregation** to permit inclusive access to innovative mechanization technologies

Mechanization and Irrigation: **New business opportunities** for laser land leveling, zero tillage, & mechanized harvesting defined with expected returns for all value chain actors

Mechanization and Irrigation: **Advancing attachment design** and commercial availability for the two-wheel tractor and mini-tiller platforms

Mechanization and Irrigation: **Market development** for importers and manufacturers of agricultural machinery

← Cereal Systems Initiative for South Asia (CSISA) in Nepal, Agronomy and Seed Systems Scaling Interventions →

GFSA Objective 2

Strengthened resilience among people and systems

Pulses: Production targeting and innovative agronomy to enhance yields and reduce risk of lentil failure

Pulses: New low-risk opportunity crops promoted by government and private sector, along with economic and nutritional messaging

Wheat: Domain-specific recommendations for management practices that will enable early wheat establishment

Precision Nutrient Management: Accessible technologies identified and commercialized for increasing the efficiency of fertilizer use

Mechanization and Irrigation: Appropriate technologies for overcoming energy and cost bottlenecks to **irrigation expansion** identified

Mechanization and Irrigation: Advancing attachment design and commercial availability for the two-wheel tractor and mini-tiller platforms

Mechanization and Irrigation: Improving capacity for machinery evaluation and design improvement among NARES partners

Mechanization and Irrigation: Strengthened training facilities and programs for rural and urban-based agro-machinery repair

Mechanization and Irrigation: Market development for importers and manufacturers of agricultural machinery

Pulses: New low-risk opportunity crops promoted by government and private sector, along with economic and nutritional messaging

Seed systems: Input dealers stock registered maize hybrids

↘ Cereal Systems Initiative for South Asia (CSISA) in Nepal, Agronomy and Seed Systems Scaling Interventions ↙

GFSA Objective 3

A well-nourished population,
Esp. women and children

CSISA-Nepal activities also map against the following Intermediate Results:

- **IR 1:** Strengthened inclusive agriculture systems that are productive and profitable
- **IR 2:** Strengthened and expanded access to markets and trade
- **IR 3:** Increased employment and entrepreneurship
- **IR 4:** Increased sustainable productivity, particularly through climate-smart approaches
- **IR 7:** Increased consumption of nutritious and safe diets

As well as these Cross-Cutting Intermediate Results:

- **CC IR 3:** Increased gender equality and female empowerment
- **CC IR 4:** Increased youth empowerment and livelihoods