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

Semi-Annual Report
2015

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International Maize and Wheat Improvement Center (CIMMYT)

Period covered: October 1, 2014 to March 31, 2015

Project Summary

Project Name: Cereal Systems Initiative for South Asia in Nepal
Organization Name: International Maize and Wheat Improvement Center (CIMMYT)
Project End Date: September 30, 2015
Grant Amount: $1,500,000
Project Duration (in months): 36 months
Report Period: October 1, 2014 to March 30, 2015
Report Due: June 15, 2015
Has this project been granted a no-cost extension? Not yet required.

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Table of Contents

Acronyms and Abbreviations

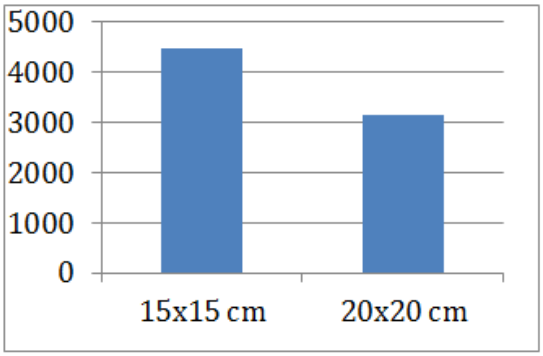
Acronyms	Full Name of Acronym
2WT	Two-wheel tractor
4WT	Four-wheel tractor
ARS	Agriculture Research Station
CIMMYT	International Maize and Wheat Improvement Center
CSISA-NP	Cereal Systems Initiative for South Asia, Nepal
DADO	District Agricultural Development Office
DOA	Department of Agriculture
DSR	Dry-seeded rice
FtF	Feed the Future
ha	Hectare
HH	House hold
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
OPV	Open-pollinated variety
RARS	Regional Agricultural Research Station
TPR	Transplanted, puddled rice
SI	Sustainable intensification
SP	Service provider
ST	Strip tillage
SWOT	Strengths, Weaknesses, Opportunities, Threats
USAID	United States Agency for International Development
ZT	Zero tillage

Highlights

CSISA's research focus in Nepal is aligned with the staple crop mandates of Feed the Future (FtF): sustainable intensification (SI) technologies for rice, lentil, and maize-based cropping systems. CSISA stages its work in the Mid and Far West development regions from offices in Nepalgunj, Surkhet, Dadeldhura, and Dhangadhi. This report covers progress and results from Kharif (monsoon) 2014 not captured in November's annual report, the Rabi (winter) season 2014–15, and the pre-harvest period for the spring season of 2015. Progress is reported by theme and documents the diverse ways that CSISA is responding to the major threats and opportunities confronting Nepali farmers. Highlights include:

Coping with drought and a variable monsoon

In the 2014 summer season, the monsoon started very late and farmers were not able to transplant rice on time, typically planting seedlings that were more than 40 days old. This led to a reduction in crop yield and an overall decrease in rice production in 2014 due to the early season drought. Under increasingly unpredictable weather conditions, devising coping strategies for building resilience for rice is becoming increasingly important.



Grain yield of rice planted with old seedling under different planting geometry

In response to this threat, CSISA has started to devise and evaluate simple agronomic practices that may build resilience to drought such as changes in planting densities to compensate for the reduced tillering capacity of old seedlings. Preliminary results indicate that increasing plant density from 20 cm x 20 cm to 15 cm x 15 cm increased yield by about 1.5 t/ha – **a 50% gain in yield with very little cost to farmers**. CSISA also conducted a household survey (N=98) in order to understand farmers' perception of various coping strategies for drought. Farmers perceived the value of planting short duration varieties (32%) and expanding irrigation availability and use (28%). Additional research has been planned for summer 2015 that will consider not only planting density adjustments but also interactions with rice varieties.

Operational land consolidation with laser leveling

Many farmers in the mid and far-western Terai split larger plots into multiple small plots by constructing temporary bunds, which are reformed each season. The primary reason for making temporary bunds is to facilitate the uniform distribution of irrigation and rainwater across larger plots. When water is unequally distributed, resource use efficiencies (water and nutrients) are reduced and crop yields decline. Making bunds and then knocking them down every season in order to address the water problem is labor-intensive and costly. Additionally, area taken up by the bunds cannot be cultivated and results in economic losses.

Making bunds to split plots in Bardiya

Laser land leveling (LLL) is performed by a four-wheel tractor (4WT)-drawn laser-guided land leveling attachment. The leveling of the field not only improves water distribution but also increases the plot size by reducing the bund area. The area previously covered by bunds can be used for crop production and the costs incurred in making bunds each season, as well as doing traditional land leveling, are saved. An average increase of 8–10% in rice and wheat yields have been recorded after using LLL in CSISA sites in the central Terai and in experiments in India. These studies also suggest that using LLL can save irrigation water by almost 15–20%. CSISA has introduced a few

LLLs in our working areas in order to conduct demonstrations and have conducted a survey of 400 households in Banke, Bardiya, Kailali and Kanchanpur districts to characterize the existing cropping systems, the presence and costs of bunds, and the potential for 'operational land consolidation' through LLL. CSISA is working with the manufacturer and dealers of LLLs to improve the market development for this technology in our working domains. The market niche and technology performance assessments conducted by **CSISA provides critical location intelligence for LLL** in the Mid and Far West development regions.

DRAMATIC INCREASE OF MECHANICAL HARVESTING WITH 2WT REAPERS FOR WHEAT AND RICE

CSISA has spent considerable time and effort over the last two years in the Mid and Far West regions demonstrating reapers for two-wheel tractors (2WT) and training service providers (SPs) on how to use them. Until recently, we had not been getting much traction in generating demand for reapers or for reaper services. In September 2014, sales of reapers for 2WT began to increase, indicating some convergence of supply and demand, and likely reflecting farmers' frustration with manually harvesting rice and wheat in areas, particularly where labor is scarce. CSISA took advantage of the increase in interest and began a new activity called, 'Jump-starting Agro-Machinery Markets' (JAMM), in which we placed 20 new reapers in local markets in the Mid and Far West regions. This initial influx of machines generated interest among farmers and spurred dealers to import and stock more, which **resulted in sales of over 100 2WT reaper/harvesters in this last wheat harvest season (March-April 2015)**.

With funding from the United States Agency for International Development (USAID), the Cereal Systems Initiative for South Asia in Nepal (www.csisa.org; henceforth 'CSISA-NP' or 'CSISA') began in August 2012 and is led by the International Maize and Wheat Improvement Center (CIMMYT). CSISA has a core mandate to sustainably intensify staple crop production through innovative management technologies, scale-appropriate mechanization, and strengthened markets for agricultural services. In Nepal, CSISA achieves impact at scale through public (e.g. Nepal Agricultural Research Council, Department of Agriculture) and private sector (e.g. seed grower associations, and other agro inputs providers) organizations, as well as USAID's KISAN project, which, like CSISA, is funded by USAID's Feed the Future (FtF) Initiative. CSISA works in the Mid and Far West development regions from four strategically located offices in Nepalgunj, Surkhet, Dadeldhura, and Dhangadhi.

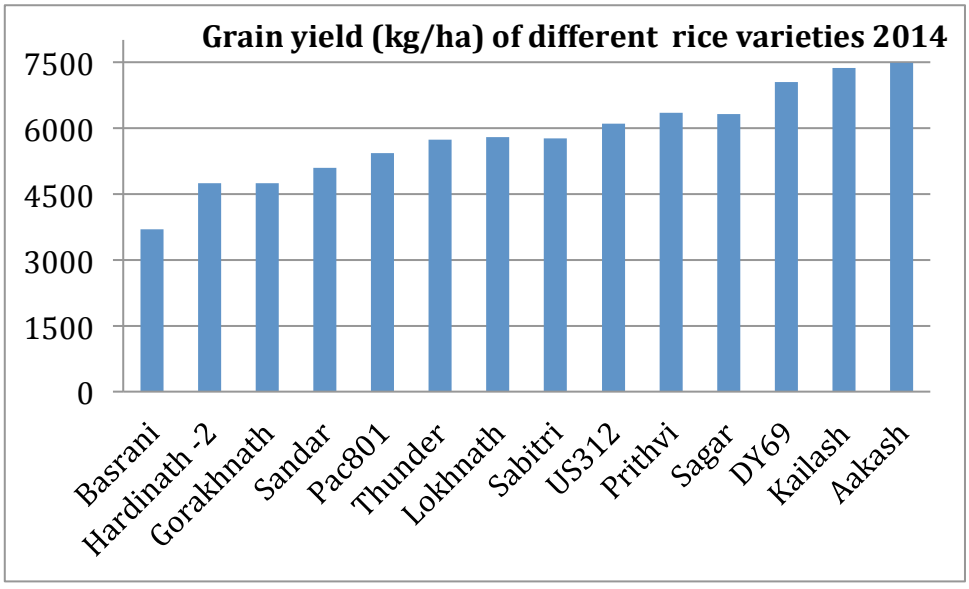
This current reporting period covers six months from Kharif harvest in October 2014 until just prior to the harvest of the winter crops in March 2015. Progress is reported by the following themes: rice, lentil, maize, mechanization, capacity development, and indicator reporting.

A. RICE

This section on rice complements and completes the summer rice season activities reflected in CSISA's annual report from November 2014 as all yield data were not available at annual reporting time.

I. PERFORMANCE OF HYBRIDS AND IMPROVED RICE VARIETIES IN THE TERAI

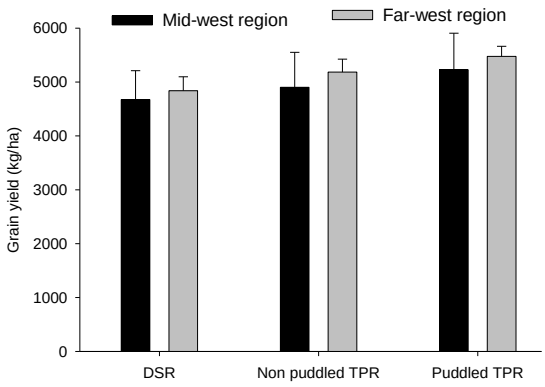
As CSISA has reported earlier, the varietal replacement rates for the major cereal crops in Nepal is very low. Farmers are still growing old rice varieties that have low yield potential. Rice yields can be increased substantially with the switch to newer, shorter-duration varieties with the additional benefit of ensuring on-time planting of winter season crops like wheat. CSISA continues to evaluate promising varieties identified and tested in the previous year (2013), along with new hybrids and improved rice varieties. CSISA carried out its activities in Banke, Bardiya, Kailali and Kanchanpur to establish the consistency of the response across seasons and locations. In 2013, improved rice varieties tested included: Tarahara-1, Hardinath-1, Sabitri, Gorakhnath, Lokhnath and Sandar, which are short- to medium-duration varieties. This past rice season (2014) CSISA included new hybrids like DY 69, Kailash, Aakash, Sagar, Prithivi and US 312, which are relatively short-duration (see graphic inset for 2014 yields). All hybrids produced higher yields compared to other improved varieties. **Among the evaluated hybrids DY 69, Kailash and Aakash had the highest yields and produced approximately 2.0 t/ha more than the commonly grown improved variety, Sabitri.** Most farmers expressed a preference for the hybrid due to high



yield and short duration. CSISA is also working with seed suppliers and local agro-vets to provide market intelligence on where increased demand of the above hybrid exists.

In parallel, CSISA collaborated with the Regional Agriculture Research Station, Khajura (NARC) in the summer of 2014 to conduct on-station evaluations of different registered rice hybrids and improved varieties under low (75:30:30 kg NPK/ha) and high (150: 60:60 kg NPK/ha) fertility levels. Compared to the improved varieties (Sabitri and Sukkha-3), **all tested hybrids produced 1–2 t/ha higher yields under both high and low fertility levels,** suggesting gains in fertilizer use efficiencies are attainable for all types of farmers. To further evaluate performance at different fertility levels (G x M x year), an on-station trial has been planned for the upcoming 2015 summer season, as well as the continuation of the on-farm experiments.

II. ALTERNATIVE RICE CROP ESTABLISHMENT PRACTICES FOR THE TERAI



DSR MATURING 7 DAYS EARLIER THAN THE TRANSPLANTED RICE IN BHURIGAUN, BARDIYA DISTRICT

Traditional rice establishment practices of manually transplanting into puddled fields costs farmers time, labor, energy, and money. Furthermore, research conducted in different South Asian countries shows that puddling degrades soil quality and causes adverse affect on the successive winter crops. Machine-sown direct seeded rice (DSR) is fast emerging as a cost-effective technology that allows the direct line sowing of rice seeds into non-puddled fields and avoids the cost for raising rice nurseries and transplanting seedlings. Building on CIMMYT's earlier work on technology verification and out-scaling through service providers in the central Terai, CSISA is evaluating DSR using both two-wheel tractor and four-wheel tractor seed drills in cooperative and joint demonstrations with KISAN.

Across the evaluation sites, our data suggests that there was no difference in grain yield between DSR and transplanted rice (TPR). However, **there was cost savings of around $200 per ha in crop establishment costs with DSR**. Similarly, the DSR crop matured 7–10 days earlier than TPR, which increases the window for the timely seeding of winter crops. CSISA-NP will continue testing DSR in 2015 to refine the technology.

In Person: *Empowering women farmers through participatory research*

CSISA has collaborated with a women farmers' group in Bardiya district in a series of field evaluations to select improved rice and lentil varieties and better bet agronomic practices. These trials have helped bring CSISA researchers closer to farmers' needs and have led to increased adoption of new technologies by women farmers.

LOKTANTRIK MAHILA KRISHAK SAMUHA WOMEN'S GROUP AT CSISA TRAINING

Loktantrik Mahila Krishak Samuha (Democratic Women Farmer Group) was formed in 2011 in the village of Neulapur in Bardiya district of Nepal to economically support empoverished women and to improve their skills in new agricultural technologies. The group, with 33 active members, now has a savings fund of NRs 250,000 (US$ 2,500), and is able to make low-interest loans to members. Since 2013, CSISA-NP has been working with this group through participatory research, trainings and demonstrations.

Farmers' Choice

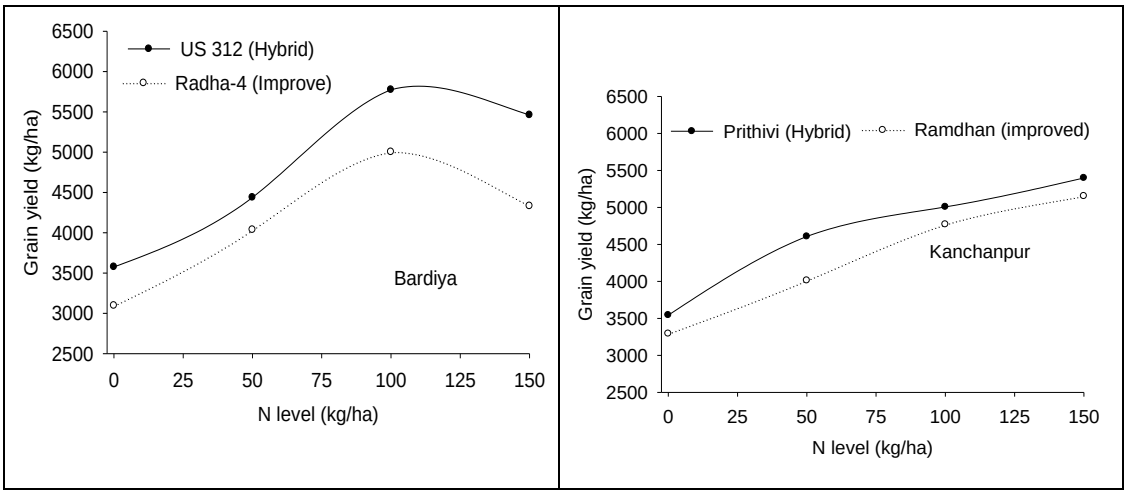
Group members participated in CSISA's evaluation of rice varieties, as well as trainings and demonstrations on rice production technologies and crop establishment methods. Among rice hybrids, the group members were able to choose from varieties such as DY 18, DY 69, Ariza, and Prithivi due to their high yielding potential and fine grain quality. The women group members expressed a preference for fine grain rice varieties for home consumption and coarse grain varieties for selling in the market.

In the winter of 2013 and 2014, a large number of farmers from the group also participated in adaptive research trials on lentil varietal selection and different agronomic practices. The group preferred Khajura 2 (released), ILL 7723 (enriched with iron and zinc) and Black Masuro, but did not express a preference for the other varieties produced. The average yield of improved varieties of lentil is 1,200 kg/ha in farmers' fields, which is nearly 50 percent higher than the commonly used variety. The group members also made income by selling lentil seeds, which were produced from these new varieties.

CSISA also introduced the group members to direct seeded rice (DSR) technologies, using both four-wheel tractor seed drills and Chinese two-wheel tractor seed drills. DSR, a technology that can provide significant cost savings to smallholder farmers, can be particularly attractive when labor availability is constrained as it eliminates the need for nursery bed preparation, puddling and transplanting of seedlings into the main field. DSR also reduces water requirements, while still providing similar grain yields achieved with transplanted puddled rice.

III. FERTILIZER MANAGEMENT

Nutrient management recommendations based on on-station research trials are often not relevant to on-farm conditions. Further, extension practitioners often perceive that hybrids need a higher fertilizer than improved varieties. Promising hybrids (DY-69, Arize, US 312 and Prithivi) were evaluated under four different levels of N (i.e., 0, 50, 100, 150 kg/ha) and compared with the improved varieties commonly grown in each location. The response to applied nitrogen was higher for hybrid at all evaluation sites as compared to the improve varieties. Across the evaluation sites, our data suggests a **consistent advantage of 0.5-1 t /ha for the adoption of hybrid with fertilizer application above 50 kg N/ha compared to improve variety**. For hybrids and varieties, nitrogen application beyond 100 kg/ha results in diminishing returns. As responses change across location, soil type and source of irrigation water, the experiment will be repeated in 2015 to assess G X E X M (genotype by environment by management) interactions.

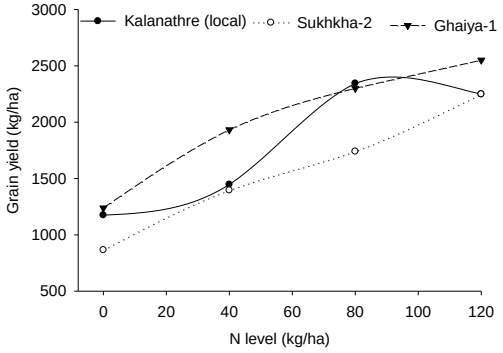


GRAIN YIELD OF HYBRID AND IMPROVED RICE VARIETIES (KG/HA) UNDER DIFFERENT N LEVELS, 2014

IV. RICE AGRONOMY IN HILL ECOLOGIES

PROPER FERTILIZER MANAGEMENT INCREASES UPLAND RICE YIELD

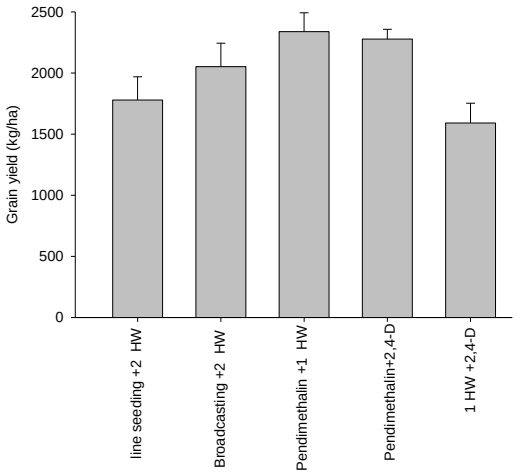
In the hills, upland rice is grown under rainfed conditions on soil with low water-holding capacity. Farmers almost exclusively use local varieties without applying fertilizers or weed management practices and, consequently, yields are extremely low (ca.1 t/ha). With the dual objectives of identifying adapted varieties and assessing the performance of those varieties under different fertilizer management regimes, CSISA began collaborative on-station research with Agriculture Research Station (ARS) Surkhet in 2014. Three varieties – Kalanathre (a local variety) and two recently released varieties (Sukhkha-3, a drought tolerant variety released for low land, and Ghaiya-1, released for upland conditions) were evaluated under four different N levels (0, 40, 80, 120 kg N/ha). Ghaiya-1 produced consistently higher yields at all N levels compared to other tested varieties, except at 80kg per ha where the yield was similar to that of the local variety. The CSISA–NARC on-station evaluation of variety X fertilizer management (see figure to the right), has shown that **it is possible to double the yield of upland rice** with application of 80 kgs of N per ha as compared with no fertilizer application (farmers' practice).



Sukhkha-2, a drought-tolerant variety released for the Terai, also grew well and yielded adequately under upland and late planted conditions. This variety will continue to be evaluated for a second year during the upcoming 2015 season.

EARLY WEED MANAGEMENT REDUCES LOSSES IN UPLAND RICE

Intense weed competition in upland rice is very common due to a favorable environment (high temperature and enough soil moisture) and the absence of persistent flooding. Manual weed management, which is typical farmers' practice in upland rice, is difficult and highly labor intensive. In collaboration with ARS Surkhet, on-station experiments evaluating efficient weed control options for upland rice were conducted in 2014. The treatments included for evaluation were:

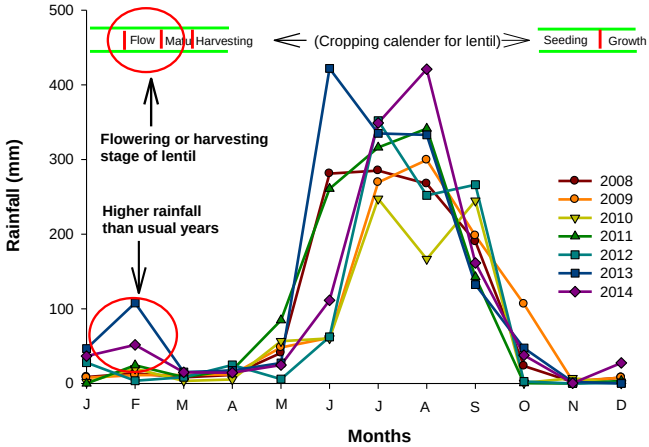


1. Broadcast seeding with two hand weedings (25 and 55 DAS)
2. Line seeding with two hand weedings (25 and 55 DAS)
3. Pre-emergence application of Pendimethalin + single hand weeding (HW)
4. Pre-emergence application of Pendimethalin + post emergence application of 2,4-D
5. Single hand weeding (at 25 DAS) + post emergence application of 2, 4-D.

Use of Pendimethalin, a pre-emergence herbicide, was found to be highly effective for controlling weeds during initial crop growth and led to significantly increased grain yield compared to hand weeding at 25–30 days after seeding. **Gross margins achieved with the use of Pendimethalin doubled (gross margin $300/ha)** compared to hand weeding at 25 days after sowing (gross margin $150 /ha). To get the cross-year data the experiment will be repeated on-station in the summer season 2015.

B. LENTIL

The western Terai is the most important area for lentil production in Nepal. In the last three years lentil production in the Terai has been severely affected by sizeable winter rain (see figure). The water logging and disease pressure associated with wet conditions that persist after rains, especially in the heavier textured soils of the Terai, has had a negative impact on farmers' yields and CSISA experiments. On the other hand, these same winter rains were beneficial for the lentil crops in the hills because of the sloping nature and coarser textured soils that facilitate drainage.



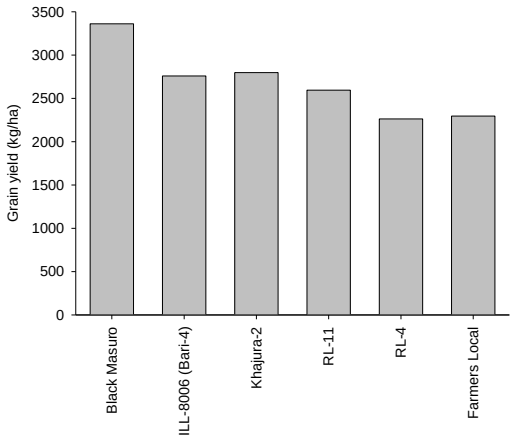
RAINFALL DURING 2008–2014 IN KHAJURA, BANKE

I. LENTIL VARIETAL EVALUATIONS

In 2014–15 in collaboration with the National Grain Legume Program (NGLP), a component of NARC, CSISA evaluated different released and pipeline varieties namely, Black Masuro, Bari-4, Khajura-2, RL-4, RL-11 both in the Terai and the hills. In all locations Black Masuro was the highest yielder compared to other varieties and it was highly

preferred by the farmers during a variety-ranking exercise. Disease infestation was also lower in Black Masuro compared to other varieties.

Similar to a year earlier, **yields were severely affected in all four Terai districts due to 3–4 sizeable winter rains, which negatively affected the lentil production; average productivity was<500 kg ha^{-1}**, due to the water logging and disease pressures associated with the wet conditions that persist after rains on the heavier textured soils in the Terai. On the other hand, the same winter rains were beneficial in Dadeldhura (mid-hills) where most varieties produced more than 2.3 t/ha as shown in the figure on the left. In Dadeldhura, yield advantage with Black Masuro (3.2 t ha^{-1}) was about 1 t ha^{-1} compared to the local variety (2.3 t ha^{-1}).



During the last three years of CSISA's lentil evaluations in different locations, the limits of existing germplasm to confer resilience to winter rains and disease outbreaks have become evident. CSISA is conducting a HH survey of lentil productivity trends that will help disentangle the relationship between soil types, rainfall, planting dates, and productivity. The analyses emerging from this survey will help farmers better manage risks for lentil.

II. LENTIL CROP ESTABLISHMENT METHODS

Farmers in the Terai commonly practice two planting methods for lentil: relay seeding into standing rice or broadcast seeding on tilled soil after the rice harvest. Under current farmers' practice, the lentil plant stand is not uniform and consequently weeds are a severe problem. Line seeding using tractor-operated seed drill machines or the use of the Earthway seed and fertilizer spreader for uniform seed broadcasting can be good alternatives for obtaining a uniform plant stand.

In 2014–15, CSISA conducted on-farm evaluations of the following crop establishment methods in different farmer fields in Banke, Bardiya, Kailali and Kanchanpur districts:

1. Broadcast seeded using spreader + tiller incorporated
2. Strip tillage with 2 wheel tractor (2WT) drill
3. Bed planting using bed planter
4. Relay seeding with standing rice
5. Zero tillage (ZT) flat using 4WT drill
6. Conventional Tillage (CT) seeding with seed drill

Crop establishment and the initial crop growth were good under all establishment methods in all locations, but due to 3–4 sizeable winter rains, lentil production was severely affected in all treatments and yield was significantly reduced (to less than 500 kg ha^{-1}). Compared to other treatments, bed-planted lentil produced better yields (around 200 kg ha^{-1} yield gain). Due to disease and rain coinciding with flowering, even the bed-planted lentil did not yield as expected as shown in the photograph below.

WELL-ESTABLISHED LENTILS ON BEDS IN FARMERS' FIELDS ON THE LEFT, AND THE SAME BEDS AFTER RAINS IN KAILALI DISTRICT.

C. MAIZE

I. STRIP TILLAGE: A SOIL CONSERVATION TECHNOLOGY FOR THE HILLS

In sloping hills, soil tillage for seeding together with hoeing and earthing up (forming beds to reduce maize lodging and to control weeds), leads to large losses of topsoil through erosion. Reducing erosion is an important component of maintaining soil fertility in the hills. To reduce soil erosion and increase soil health, plowing and seed placement can be done in narrow 5–10 cm wide strips, a practice called strip tillage. As a complementary strategy, CSISA has introduced reel-type 'push' mowers that can efficiently suppress weeds and reduce drudgery without disturbing the soil when the crop is sown in lines.

In the 2014 summer season, CSISA evaluated the following treatments in different farmers' fields in the mid hills (i.e., Dadeldhura and Surkhet):

T1: Strip tillage (ST) + line seeding (LS) + farmers method of weed management (HW)

T2: Strip tillage + line seeding + mower for weed management

T3: Full tillage + line seeding + farmers method of weed management
T4: Full tillage + line seeding + mower for weed management
T5: Full tillage + broadcast seeding+farmers method of weed management

There was no difference in the grain yield of maize in any of the treatments. Under strip tillage and with use of the reel-mower, visual observation suggested significant reductions in erosion along with reductions in labor requirements.

II. MECHANIZED SOLUTIONS FOR SEEDING SPRING MAIZE IN THE TERAI

The manual seeding of maize in lines is tedious and requires a large amount of labor, which increases the total production cost. Due to the 'Jumpstarting Agro-Machinery Markets' (JAMM) initiative there are now many more options for mechanizing maize planting. CSISA has been demonstrating and evaluating different types of scale-appropriate machinery for seeding maize both in the hills and the Terai to evaluate the crop establishment and economic benefits of each machine, as compared to manual seeding. The below is a sample of existing and relatively new machinery that is being used in trials and in farmers' field demonstrations.

NATIONAL AGRO MULTI-CROP PLANTER USED FOR SEEDING THREE ROWS OF MAIZE IN ZERO-TILLED SOIL

NATIONAL AGRO MULTI-CROP PLANTER USED FOR SEEDING TWO ROWS OF MAIZE IN A TILLED FIELD

4WT-DRAWN NATIONAL AGRO BED PLANTER, SEEDING MAIZE ON TWO BEDS

CHINESE 7-HORSEPOWER MINI-TILLER DRAWN FOUR-ROW PLANTER SEEDING MAIZE IN TWO ROWS

CHINESE PUSH ROW PLANTERS CAN BE USED IN TILLED AND STRIP-TILLED SOIL

CHINESE JAB PLANTERS CAN BE USED IN TILLED AND STRIP-TILLED SOIL

Economic analysis of each machine will be presented in the 2015 annual report, after crops are harvested. CSISA is working on the development of local service providers and local markets to commercialize these technologies.

D. MECHANIZATION

For technologies to successfully spread and have a beneficial impact three enabling conditions need to be present: 1) widespread awareness (demand); 2) increased private sector capacity to respond to demand for machinery (inputs and services); and 3) a network to sustain and support the service providers and their machinery in the field.

In the last half-year, CSISA has been very active in demand generation for appropriate-scale agricultural technologies through demonstrations, farmer field days, agricultural fairs and service

provider trainings. As shown below, CSISA's small team has been very active, but cannot by itself achieve the scale that is required for transformative change. CSISA leverages the strength of its partners such as KISAN and private importers and dealers, which notably have also begun their own farmer field days based on their new agro-machinery technologies.

I. SERVICE PROVIDER TRAININGS

CSISA's service provider trainings focus on farmers who own a 2-wheel or 4-wheel tractor, or who are interested in a near-term purchase. CSISA provides technical and business training, encouraging farmers who could either borrow or purchase a machine to begin providing services to their neighbors. Usually an experienced "lead service provider" is invited to these trainings to act as a trainer and a role model. Additional trainings for lead service providers are for those SPs who have already bought a machine and would be provided more in-depth technical, agronomic and business skill development training. There are few SPs in the Mid and Far West, as compared to the Central and Western development regions.

Two service provider trainings were held in March 2015 near Nepalgunj and Dhangadhi. The two-day program in Nepalgunj held on 18–19 March had 20 participants and covered a wide range of topics including improved agronomy for spring maize, including conservation agriculture, and introduced service providers to over ten different machines including two wheel tractor seed drills and their use and calibration (picture to left) and demonstrations of strip-till maize.

The second two-day training was held at Authariya Bazaar near Dhangadhi on 28–29 March 2015 with approximately 40 potential lead service providers. This training also focused on familiarizing the SPs with a wide variety of machines and agronomic practices, but also covered mechanized wheat harvesting including the self-propelled reaper, 2WT reaper attachment, and motorized scythe blade for harvesting wheat. The photo to the left shows a woman who was an outside observer to the training trying her hand with the powered brush cutter for harvesting wheat.

II. FIELD DEMONSTRATIONS

CSISA field staff invest significant time on demonstrations in farmers' fields, which include not only experiments and trials, but also targeted assistance on how to use new machines to plant or harvest. There are also activities where we simply want to test new machinery (new to us and new to farmers) and to solicit farmer feedback. The box below provides a sample of the types of demonstrations by one of the CSISA field teams over a 3-day period during maize season.

Date	Demonstration	Location
17/2/2015	Maize seeding using 4 wheel tractor seed drill	Several farmers field in Banke, Bardiya, Kailali, Kanchanpur districts

18/2/2015	Mini-tiller maintenance and maize seed drill 2 line demonstration 3 katta demonstration with Chinese push row maize planter Testing and demonstrations of Bangladeshi 2WT bed planter machine	Farmer fields in Shreepur, Kailali
19/2/2015	Maize seed drill cum bed planter demonstration	Farmer fields in Belhaniya, Banke

III. AGRICULTURAL FAIRS AND FIELD DAYS

District Agriculture Development Office, Dadeldhura, organized an Agricultural Fair on 14–15 January 2015 in Dadeldhura on the occasion of *Maghe Sankranti* this year. CSISA managed an exhibition stall showing and demonstrating various small machines appropriate for Nepal's hill agriculture such as mini-tillers, jab planters, seed drills, self-propelled reapers, paddle rice threshers and electric powered and manual maize shellers. As reported by Krishna Prasad Gupta, CSISA Technical Field Officer, approximately 5,000 people attended the fair.

Field days bring groups of farmers from KISAN and the Department of Agriculture together for a half-day to see and evaluate varietal trials or to observe and evaluate improved technologies introduced by CSISA across different locations.

DADELDHURA, CSISA'S STALL WAS THE MAIN ATTRACTION AT THE FAIR.

IV. AGRO-MACHINERY MARKET DEVELOPMENT

Working in the West development region, CSISA had previous experience working in an environment where there were established and mature agro-machinery markets and relatively high awareness for some of the targeted machinery like 4WT and 2WT seed drills, 2WT reapers and even LLLs. In the Mid- and Far West regions, though, where there are only 4WT dealers, machinery markets are less well established and, in general, farmers' awareness of agro-machinery is considerably lower.

CSISA's core strategy for market development is to strengthen custom-hire agricultural services. CSISA and its partners envision that service providers will provide access to agricultural machinery for smallholder farmers. Yet, multiple diverse interventions must be made to strengthen markets such that thousands of service providers are sustainably providing services to tens of thousands of farmer clients. Linkages must be strengthened – from the training of SPs and rural mechanics to the backstopping of importers and their local sales agents, dealers and mechanics, who are the central

support structure for successful service providers. CSISA has been very active in the last six months backstopping the private sector and helping to increase supply of targeted machinery:

A. The new NAMEA

Nepal Agricultural Machinery Entrepreneurs Association (NAMEA; in earlier CSISA reports they were referred to as Agro-Machinery Merchants Association or AMMA) became an officially registered professional organization in mid-December 2014. With market intelligence and backstopping support from CSISA, NAMEA members have begun to sponsor their own marketing and training activities for increasing machinery sales via farmer field days as well as sponsoring national and regional agro-machinery fairs. Additional support to NAMEA by CSISA has been in the form of travel assistance for two of its members to the Patna Agro Trade Fair. To obtain the travel support the members had to report back to the larger group about what they found interesting at the fair. One remarked that the fair had only traditional agro machinery and tools and that he was considering how he could break into the Bihar market with new machinery.

B. Jumpstarting Agro-Machinery Markets (JAMM) in Mid and Far West development regions

During September and October 2014, CSISA placed orders for nearly $100,000 to 'jumpstart' the sales of select scale-appropriate agricultural machinery for the Mid and Far West markets. This idea came from the stalled KISAN Small Grants Program (jointly devised with CSISA) that was attempting to provide grants to facilitate importers to: (1) establish new sales agents and dealers in the Mid and Far West; (2) place these new agro-machinery that was not yet commercially available in the west with new and established dealers; and (3) backstop the importers and their dealers to organize their own farmer field days and machinery demonstrations.

Unlike KISAN's plan, CSISA thought to place this large stock of agricultural machinery on a consignment basis. For example, Habi Auto placed 10 of the 20 zero till seed drills imported from National Agro in India to Habi's existing agents in Nepalgunj and new dealers in Gulariya, Bardiya and Dhangadh in Kailali District. Similarly, 20 two-wheel tractor reapers ordered from two importers (SK Traders and Kubir and Sons) were placed with SK Traders and Kubir and Sons' new agents in Mid- and Far West (see "Reapers Explode into the Market" section below). Through this free 'stocking' of machinery and the urging of CSISA, the importers and dealers are expanding their own field demonstrations of the targeted machines.

C. Far West regional agents' meeting

On December 22, 2014 the first-ever Far West regional agro machinery agents' meeting was held in Dhangadhi. Approximately 30 participants from various agencies and projects, as well as nine different companies, attended. The objectives of the meeting were to create a regional platform or professional association similar to NAMEA that would develop and strengthen the agro-machinery dealers' technical capacity, improve their business linkages and increase their business acumen, resulting in an accelerated spread and use of targeted technologies by Far West farmers. As an example of the capacity building provided, Mr. Shiva Bhandari, Chief Customs Officer, Dhangadhi, clarified the tariffs and other charges applied to imported agricultural machinery. A follow-up meeting will be held in late June 2015.

CSISA envisions this group becoming self-sustaining over time like NAMEA. In the extension of CSISA-NP that began in February 2015, funded by USAID Washington and USAID India, CSISA will support this new group to manage a one-week long Far West regional agricultural machinery trade fair, which would also earn income for the group.

V. Achieving scale: Reapers explode onto the market

The sale of approximately 100 two-wheel tractor reapers this wheat-harvesting season (March–April) was in some ways unexpected by CSISA, DOA and private importers. For the last two years an

array of demonstrations and trainings for 2WT reaper attachments, self-propelled reapers, and now mini-tiller reaper attachments have been conducted by CSISA, NARC's Agri Engineering Division, DOA's Engineering Directorate and, just as importantly, various private sector importers like SK Traders, BTL Traders and Kubir and Sons. Yet, sales lagged such that only a few were sold in those two years. In September–October when CSISA gave an initial order of twenty reapers for its JAMM program, the team was hopeful that they might sell 5–10 of these reapers in the coming wheat season. In December CSISA learned that Kubir and Sons and BTL developed confidence about the future of reapers in the west, and ordered an additional 25–50 pcs each.

When the CSISA orders began to arrive in January–February 2015, CSISA insisted that the importers come with their machines to the west and place the CSISA-purchased machinery with their agents. On one visit to the Far West, Scott Justice reported that he saw two CSISA reapers in a new shop just to the west of Artariya Bazaar on the East West Highway. When chatting with the store owner he found that the owner had no idea that the machinery belonged to the CSISA Project and insisted it was the importer's machine: which is just what a mechanization promotion project like CSISA should be doing – enabling, but staying out of the way and letting business flourish. It appears that along with sales of 25 reapers from BTL traders (mostly in eastern Kailali), 10 reapers from SK Traders, 20 reapers from CSISA's JAMM program (in Banke, Bardiya, Kanchanpur and Kailali) and more than 50 reapers from Kuber and Sons (mostly in the Far West) were sold this past wheat season, whereas essentially zero had been sold in the previous year. Already SK Traders, Kuber& Sons, SKT, and BTL Traders are planning to order several more containers – perhaps over 100 reapers each – in anticipation of even higher demand in the coming rice season.

CSISA is working with NAMEA members to ensure that early buyers have access to operator trainings, mechanics have access to reaper repair trainings, and that local dealers are stocked with spare parts.

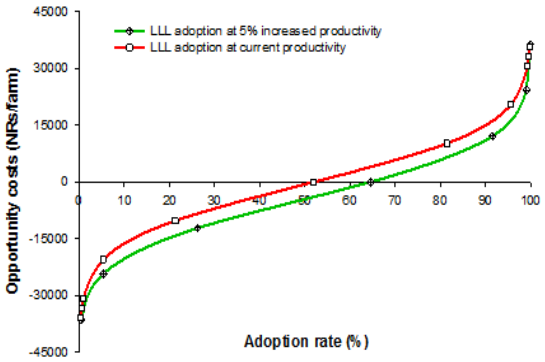
VI. Leading with research: International Conference on Ag Residue Burning

CIMMYT participated in the Conference on Open Burning of Agricultural Residues in the Himalayan Region in Kathmandu, 20-21 February 2015 at ICIMOD (http://www.icimod.org/?q=17365). CSISA Agricultural Economist, Gokul Paudel, presented the paper, Conservation Agriculture: a resilient way to exterminate trade-offs in combine harvester use and residue burning in rice-wheat systems of Nepal. The report, which was based on last season's fieldwork on combine harvester use in Nepal by CIMMYT Agricultural Engineering Intern Subash Adhikari, has generated so much interest that the conference organizers, International Cyrosphere Climate Initiative (ICCI), has requested CIMMYT Nepal to consider submitting a project proposal to them for promotion of strategies and technologies to reduce the crop residue burning in Nepal. CSISA and its national partner NARC has generated evidence on many proven and even new potential solutions (e.g., Happy Seeders, small-scale residue straw management equipment like straw bailers, rakes, etc.) for managing residues from combines.

In Focus: *Scoping study for laser land leveling*

Farmer constructing bunds

Farmer using laser land leveler



Results indicate that as crop productivity increases, LLL adoption increases, which improves the gross margins for crops.

Many farmers in the mid and far-western Terai split their relatively large plots into multiple small plots by constructing temporary bunds, which are knocked down and reformed each season. The primary reason is to facilitate the uniform distribution of irrigation and rainwater across the undulating larger plots. When water is unequally distributed, crops can't absorb nutrients appropriately and crop yield declines. Making bunds and knocking them down every season is labor-intensive and costly. Additionally, area taken up by the bunds cannot be cultivated and results in economic losses.

Laser land leveling is performed by a four-wheel tractor (4WT)-drawn laser-guided land leveling attachment. The leveling of the field to a 0% slope not only improves water distribution but also increases the plot size by reducing the bund area. The area previously covered by bunds can be used for crop production and the costs incurred in making bunds each season, as well as doing traditional land leveling, are saved. An average increase of 8–10% in rice and wheat yields have been recorded after using LLL in CSISA sites in the central Terai and in experiments in India. These studies also suggest that using LLL can save irrigation water by almost 15–20%.

Upon seeing these results, CSISA has introduced a few LLLs in our working areas in order to conduct demonstrations. In a complementary study, CSISA has begun a survey of 400 households in Banke, Bardya, Kailali and Kanchanpur districts to characterize the existing cropping systems, the presence and costs of bunds, and the potential for 'operational land consolidation' through LLL. A sample of 40 farmers has been randomly selected and is being directly observed for the areas captured by the bunds.

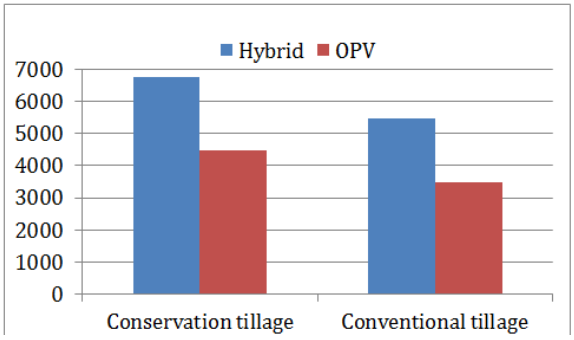
Initial findings of the 40 HHs

- On average, 6% of the potential rice area and 5% of wheat area is covered by bunds in farmers' fields
- Survey suggested that at current productivity levels, 53% of the farmers would be likely to adopt LLL. If productivity were to increase by 5%, 65% of farmers would likely adopt.
- At the predicted adoption rate farmers could increase returns from wheat and rice by ~ NRs. 7,000 per farm, and average rice yield could increase by 150 kg per farm.

E. Research Capacity Development

CSISA provides technical and financial support for seven PhD candidates who are staff members at either DOA or NARC to build capacity while broadening and strengthening CSISA's field research.

One of our students, Mr. Hari Prasai (PhD candidate from NARC) conducts research entitled Evaluation of Conservation Agriculture Technology in Maize-based Cropping Systems for Far Western Hills. His research seeks to evaluate the performance of different crops in maize-based cropping systems under conservation and conventional agriculture systems in the Far West hills. The experiment was conducted in RARS, Doti during summer 2014. The treatments evaluated were: 1) Tillage method: two tillage methods, i.e., conservation tillage and conventional tillage; and 2) Variety: two varieties, i.e., Hybrid (Rajkumar) and OPV (Arun-2). Preliminary research data shows that hybrid maize produced 35% higher yield than the OPV under both tillage methods. Just as encouragingly, yield performance of both hybrid and OPV was approximately 1 t ha^{-1} higher with conservation agriculture-based management.



YIELD PERFORMANCE (KG/HA) OF MAIZE VARIETIES UNDER CONVENTIONAL AND CONSERVATION TILLAGE, DOTI, 2014

As a part of the celebration of International Year of Soils 2015 with the theme "Healthy soils for a healthy life", CSISA collaborated with NARC's Soil Science Division to organize a National Soil Fertility Research Workshop on March 24–25, 2015 in Kathmandu.

The main goal of the workshop was to provide a common platform for sharing knowledge and expertise on all aspects of soil science-related research in Nepal and to compile all soil science-related research information and data available in the country. More than 120 scientists and technical experts participated in this workshop. CSISA-NP provided both technical as well as financial support for this workshop.

PARTICIPANTS OF SOIL FERTILITY RESEARCH WORKSHOP, MARCH 24-25, 2015, NARC,

F. Business Development Initiatives

I. Business Mentoring for Local Seed Enterprises

CSISA assessed 13 cereal seed enterprises with reference to their organizational development, research and development capacity, seed production, processing and value addition and marketing through a semi-structured questionnaire and a SWOT analysis. Results show that the seed transaction volume of these enterprises is far below the national requirements. The growth of the enterprises is mainly constrained by the limited availability of source seed, poor seed storage and processing facilities, a lack of trained human resources, and limited financial capital. Seed enterprises argue that improper seed subsidy schemes and unpredictable/erratic weather patterns (e.g. heavy rainfall during crop harvest) are posing risks for their growth. To address these internal and external challenges, CSISA is facilitating these enterprises to develop their business plans, as well as to network and foster collaboration with Indian seed companies. Drawing on the lessons of the assessment, a paper entitled 'Current status, challenges and opportunities for the growth of seed enterprises' has been prepared. To facilitate the distribution of registered hybrid maize in the market, CSISA also organized interaction meetings so that hybrid maize value chain actors can understand the constraints to, and opportunities for, hybrid maize promotion. CSISA is supporting

NARC and Nepalese and Indian seed companies in the design of a protocol for the testing of new hybrid maize varieties.

II. PARTNERSHIPS TO IMPROVE THE AVAILABILITY OF REGISTERED HYBRID MAIZE SEEDS

CSISA team members visited and interacted with hybrid maize seed traders across the Central, Western, Mid-West and Far West development regions to understand the current situation of hybrid maize distribution, production area, cropping patterns and seasons for maize production. It was found that about 2,500 t of hybrid maize seed is imported into Nepal through Birgunj, and >60% of this import is through informal channels. Farmers grow hybrid maize both in winter (November planting) and spring (February planting) in the central Terai, but spring season planting is not common in the western zones. There is limited distribution of hybrid maize seed in hilly areas, and the insufficient availability of short-duration and white-grain hybrid varieties in the market are major constraints to its distribution. To facilitate the promotion of registered hybrid maize varieties, a traders' meeting was organized in Chitwan on April 16, 2015 convening eight hybrid maize seed dealers and distributors. At that meeting, CSISA presented the findings of agronomic and varietal trials carried out by CIMMYT through different projects, and shared lessons on how Indian seed companies addressed constraints associated with trading registered hybrids in Nepal.

Also importantly, there is a lack of registered hybrid maize varieties recommended for western regions, and very few for the hills. Traders feel quite hesitant to promote non-registered hybrids. To address the hybrid maize registration issue, CSISA is coordinating with NARC and Seed Quality Control Center to explore whether there is a possibility to extend the recommendation domains for the already-registered hybrids. Similarly, the team is exploring opportunities to forge partnerships among NARC, local seed companies (Nepal), Indian seed companies and CIMMYT for the testing of promising hybrid maize materials across the maize production domains.

III. MUNGBEAN PROMOTION INITIATIVE

With the aim of increasing the promotion of mungbean in Nepal, CSISA has collected import data for mungbean, interacted with National Grain Legume Research Program, mungbean- based cottage industries, growers and seed producers. Findings show that large quantities of mungbean are imported from India, as domestic production cannot meet the growing demand. For instance, Nepal imported 251MTsof mungbean grain from India during the period from January 2013 to February 2015 via Raxaul boarder, worth of US$160,452 (NRs. 1,6045,200). It means mungbean is imported from India for NRs. 100/kg, and it is sold in the retail market for NRs 180/kg. Traders estimate that the aforementioned import data does not reflect the actual mungbean import in Nepal from foreign countries as importing pulses from India is banned. They estimate that over 10 t of mungbean grain is consumed in Nepal daily, and about 60% of this quantity is consumed in Kathmandu. The major buyers are snack food (dalmut) manufacturers. Traders consider that limited production and a lack of mungbean processing facilities (e.g. dehusking machines) are the major constraints to its promotion. Information collection on mungbean from farmers, traders and NARC stations continues, and specific actions/strategies for mungbean promotion through CSISA will be developed after collecting and analyzing information from the fields.