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# ADVANCING SUSTAINABLE INNOVATIONS FOR A FOOD SECURE FUTURE IN INDIA

Major Impacts of the Cereal Systems Initiative for South Asia  
**2012-2015**

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# CSISA AT A GLANCE

## Challenges in South Asia



The world will have  
**9.2 billion**  
people by 2050. Most  
of this population increase  
will happen in developing  
countries, particularly in  
Asia and Africa.

These countries will have  
**to increase**  
agricultural production  
**by 100%**  
to meet food demand alone.



South Asia has  
the **largest number**  
of **poor and**  
**undernourished**  
people in the world.



**70%**

of the world's farmers  
are smallholders  
who provide

**80%**

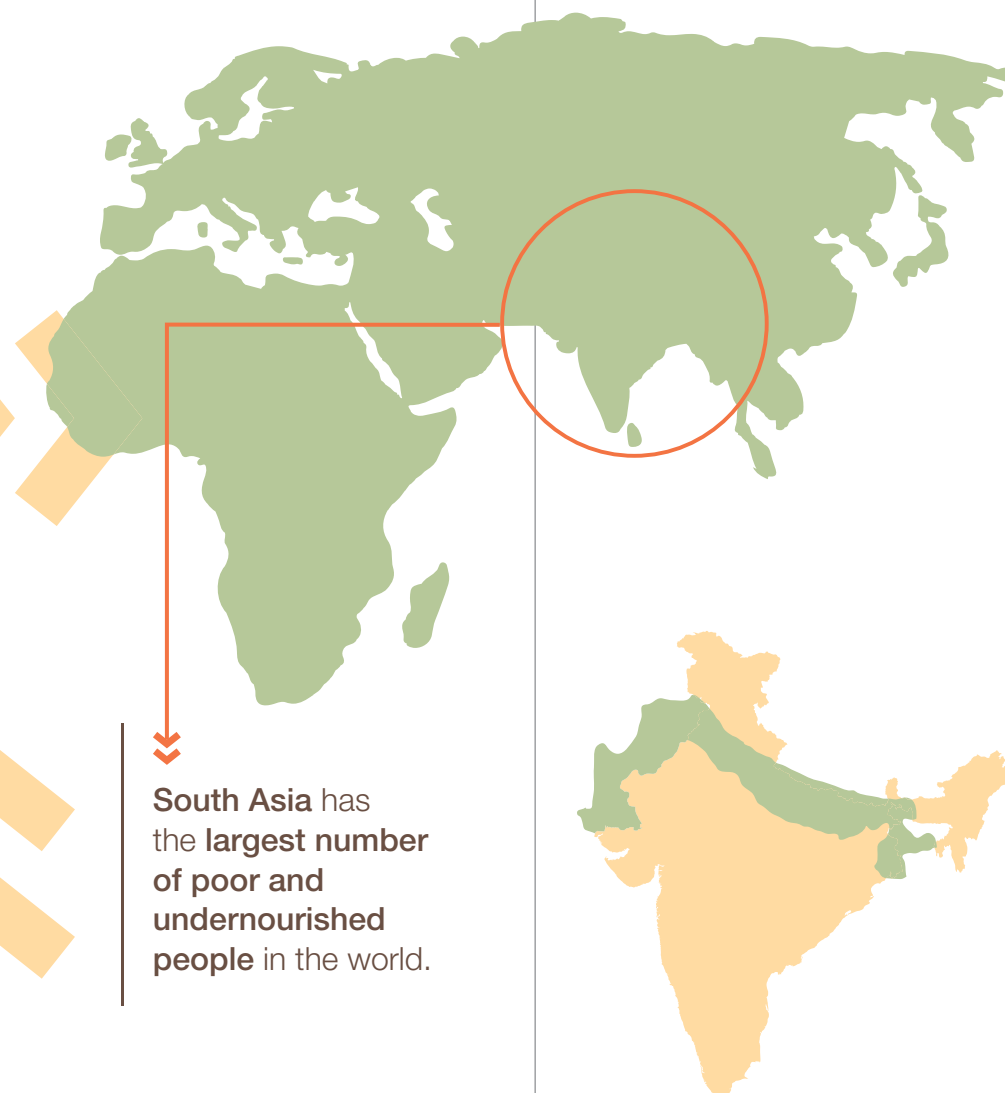
of the food  
consumed in the  
developing world.

**CEREALS**  
Rice, wheat  
and maize



Provide staple food for  
**571 million**  
people in South Asia  
subsisting on  
**<US\$ 1.25**  
**a day**

Many cereal cropping systems also  
integrate livestock and/or aquaculture.



## What is CSISA?

The Cereal Systems Initiative for South Asia (CSISA) works to reduce hunger and increase food and income security of resource-poor farm families in South Asia through the development and inclusive adoption of new cereal varieties, sustainable agricultural technologies and policies.

It complements regional and national efforts and partners with civil society, public and private sector organizations.

CSISA is led by the International Maize and Wheat Improvement Center (CIMMYT) and is implemented jointly in India with the International Food Policy Research Institute (IFPRI), the International Livestock Research Institute (ILRI) and the International Rice Research Institute (IRRI).

## Where CSISA works

South Asia's Indo-Gangetic Plains – home to the region's most important grain baskets – in Bangladesh, India and Nepal.

## What CSISA does

- Promotes labor-, water- and energy-saving agricultural practices
- Develops high-yielding, heat-, drought-, flood- and biotic and abiotic stress-tolerant cereal varieties
- Improves farmers' access to market information and enterprise development
- Promotes climate-resilient farming technologies
- Strengthens policy analysis to accelerate new technology adoption
- Establishes strategic partnerships and builds capacity to create impact at scale



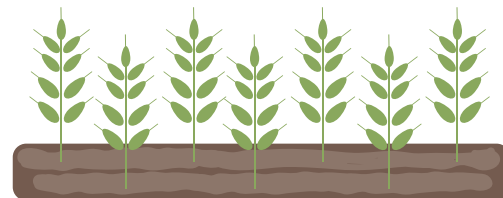
## CSISA IMPACTS

### Haryana and Punjab

Research at Haryana showed that **Kharif maize is a suitable and profitable alternative to rice** in northwest India to address scarcity of water. Punjab Agricultural University adopted CSISA's recommendation of a drip irrigation schedule for spring maize to save irrigation water.

### Eastern Uttar Pradesh

Use of long duration wheat varieties doubles wheat yields.

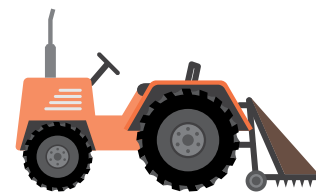


### Bihar

The area planted with **zero tillage wheat has increased by 42%** between 2012 and 2015.

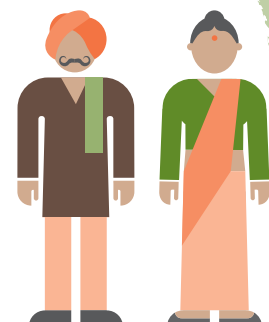
### Odisha

The number of farmers practicing mechanical transplanting of rice increased from **40 in 2013 to 2,000 in 2015.**



### Tamil Nadu

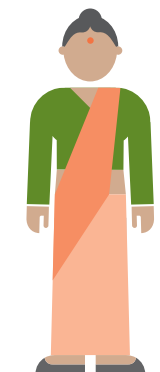
Reached more than **25,000 farmers** and has covered more than **28,000 hectares** through water- and labor-saving agricultural technologies.



## CROSS-CUTTING IMPACTS

### Empowering Women

More than **1,500 women farmers** across Bihar and Odisha adopted at least **one improved agriculture practice in 2013-14.**



### Better Seeds

Released **49 new wheat varieties** and **5 new rice varieties** suited for cultivation under direct seeded rice method.



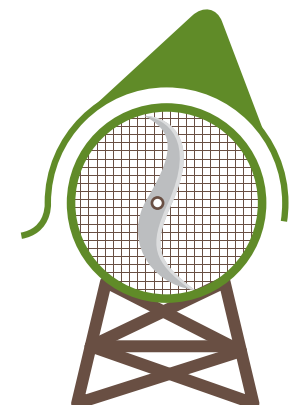
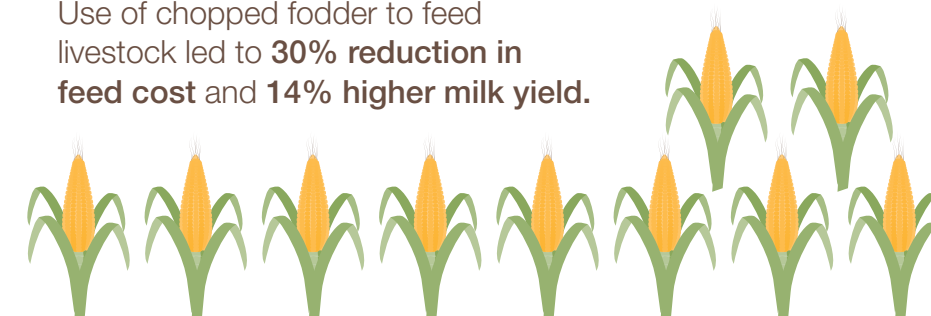
**5 new rice varieties**



**49 new wheat varieties**

### Improved Livestock

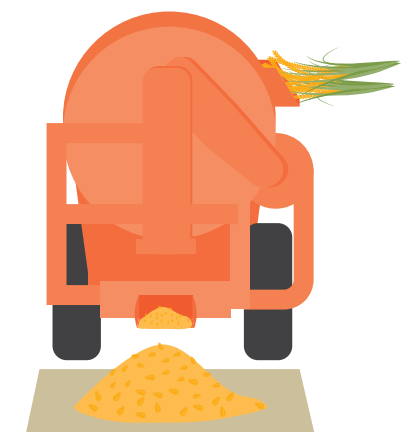
Use of chopped fodder to feed livestock led to **30% reduction in feed cost** and **14% higher milk yield.**



### Postharvest

More than **150 axial flow threshers** deployed through service providers facilitated advancement of wheat sowing.

**150 axial flow threshers deployed**







## Early Sowing of Wheat

# CLIMATE RESILIENT PRACTICES GAIN FARMERS' CONFIDENCE

Traditionally, farmers in eastern India have planted wheat in late November or early December, making the crop more vulnerable to damage from late-season heat, called terminal heat, when it exceeds 35°C. CSISA research shows that productivity progressively declines from more than 5 to less than 2.5 tons per hectare when sowing is delayed from the first half of November to the last half of December.

In 2009, CSISA, through the International Maize and Wheat Improvement Center, launched a campaign in Bihar and eastern Uttar Pradesh to promote early wheat sowing, between 1 and 15 November, to help combat the negative effects of terminal heat. Early wheat sowing, in combination with zero tillage (ZT), can increase yields as the crop is more likely to avoid damaging heat during the grain-filling stage. Early sowing also allows farmers to adopt high-yielding, long-duration wheat varieties, which can further improve productivity.

Zero tillage is the way of growing crops from year to year without disturbing the soil through tillage, thus saving irrigation water, increasing organic matter retention and nutrient cycling and suppressing weeds. In the heat- and stress-prone eastern Indo-Gangetic Plains, early sowing of wheat and ZT are important adaptations for coping with the present and projected climate extremes.

CSISA increased adoption of early sowing and ZT through sharing relevant data with policy makers, demonstrating the benefits in farmers' fields, training service providers in ZT technology and educating extension staff, input dealers and distributors. Most



Early wheat sowing is a non-cash input that even smallholder farmers can benefit from and is one of the most important adaptations to climate change in the eastern Indo-Gangetic Plains.

importantly, CSISA joined the Bihar Department of Agriculture's seasonal planning meetings, sharing relevant research findings and providing evidence of the benefits of early sowing and ZT. Influenced by CSISA's findings, in 2013 the Bihar Department of Agriculture modified its highly influential advisory to farmers, officially recommending that farmers sow wheat before November 15.

CSISA surveys show that 340,000 farmers in Bihar and 280,000 farmers in eastern Uttar Pradesh now practice timely sowing of wheat.







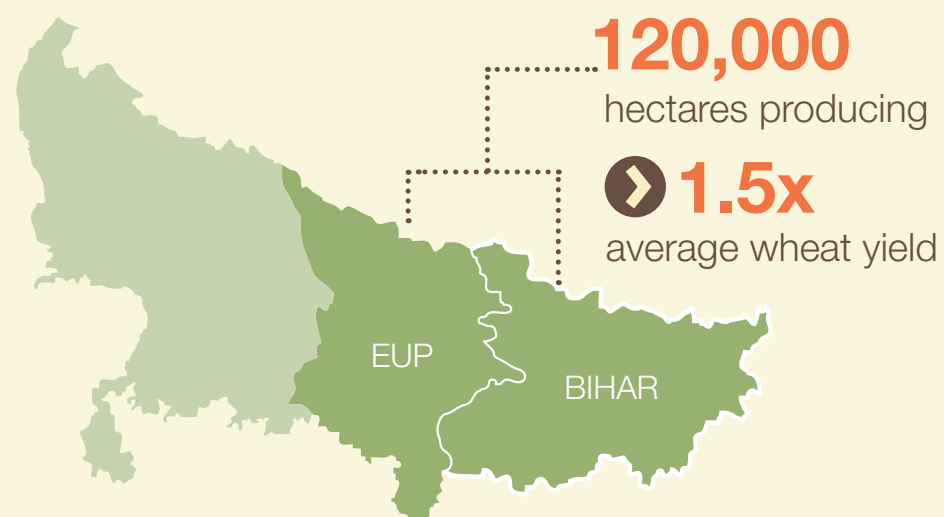
## ➤ RESEARCH RESULTS

CSISA's research demonstrates that by combining crop diversification with conservation agriculture and precision resource management, crop yields and land productivity can increase by 11 percent, irrigation requirement can decrease by 71 percent and overall profitability can increase by 32 percent.

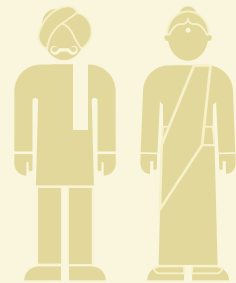
## ➤ IMPACT IN NUMBERS

More than **120,000 hectares of wheat** now benefit from timely planting across Bihar and eastern Uttar Pradesh hub districts due to the combined efforts of CSISA and the state agriculture departments.

Early sowing of wheat resulted in a grain harvest of nearly **1.5 times** the Indian average yield of 3 tons per hectare. Under best conditions, early sowing has given a grain harvest of up to **7.3 tons per hectare**.







## Mechanical Transplanting of Rice

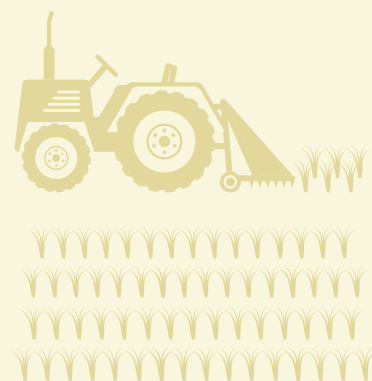
# HELPING FARMERS OVERCOME LABOR SHORTAGES

Sabriti Nayak, a tribal farmer from Badjod village in Odisha, required 10 to 12 farmhands for two days to manually transplant 0.4 hectare of rice seedlings. However, she would often face labor shortages at peak rice-sowing times. After working for long hours in wet fields for nursery preparation, uprooting and transplanting seedlings, Nayak would develop skin problems and other ailments. Faced with the risk of scarce and expensive labor, last year she adopted mechanical transplanting of rice. By doing so, she could not only sow the same area in just one hour without any laborers, she didn't have to worry about skin infections either.

The mechanical transplanter plants rice seedlings at precise depths and spacing, decreasing the time and drudgery involved in a task that is mostly done by women farmers in India.

In collaboration with the Odisha Department of Agriculture, CSISA worked over the past three years to popularize the mechanical transplanting of rice in puddled and non-puddled conditions. From a very low base of 40 farmers adopting machine transplanting of rice in 2013, CSISA, through the International Rice Research Institute, has facilitated more than 2,000 farmers, covering nearly 2,200 hectares across the districts of Puri, Bhadrak and Mayurbhanj, to adopt mechanical transplanting.

CSISA facilitates farmers to become service providers by providing them hands-on technical training, linking them with machinery dealers and helping them evaluate their profitability. CSISA also provides business development support to service providers so they can create mat-type rice nurseries and sell rice mats for mechanical transplanting.



Farmers in Odisha have begun adopting mechanical transplanting to address labor scarcity and the high cost of labor. To increase adoption and access to machines, CSISA links service providers with machinery dealers and helps them evaluate the profitability and 'business case' for mechanical transplanting.

It used to take 15 laborers one full day to transplant rice seedlings onto farmer Anam Behera's field in Puri district's Malikpali village. "When I first heard about mechanical transplanting I was immediately impressed by the fact that my labor requirement would be reduced to nearly zero," said Behera. As an added bonus, he now saves approximately 13 kg of seeds as well besides also reducing his tractor's fuel consumption.







## ➤ IMPACT IN NUMBERS

In Odisha, the number of farmers practicing mechanical transplanting of rice increased from **40 in 2013 to 2,000 in 2015**.

Mechanical transplanting saves farmers about **US\$ 100 per hectare** when services are procured through service providers.



Mechanical  
transplanting saves  
**US\$ 100**  
per hectare



Farmers practicing mechanical  
transplanting of rice

**40** ➤ **2,000**  
in 2013 in 2015







## Hybrid Maize

# IMPROVING FOOD AND NUTRITIONAL SECURITY

Half of the potentially arable land in the plateau areas of Mayurbhanj district of Odisha is considered unsuitable for growing rice and remains fallow for most of the year. With high poverty and low literacy rates, these uplands are home to four indigenous tribes: Santal, Ganda, Bathudi and Lohar. Some tribal families grow local varieties of maize in home gardens for household consumption and sell the little surplus as green cobs in the local market. However, yields are often low because farmers use old varieties and traditional sowing methods and lack information about modern agronomic practices to control weeds and manage inputs.

In collaboration with Odisha Department of Agriculture, CSISA started working with women's self-help groups (SHGs) in this area to improve maize yields through collective maize farming. One such women's SHG, Johar Jaher Ayo, earned net profit of US\$ 240 in 2014 by selling surplus green maize and maize grain, in addition to harvesting a ton of green maize for use by their families and relatives.

In this year, five more SHGs practiced collective maize farming in Badbil village in the plateau area. Saraswati SHG earned a profit of US\$ 1,200 and Subhapatni SHG earned US\$ 1,000 by selling green cobs and dry grain.

All these groups have adopted a package of improved practices introduced by CSISA, which include use of hybrids, appropriate plant population using seed drill machine and judicious nutrient management.



**N**on-accessibility of a maize grain market leads to distress sales of green cobs by farmers in local markets. CSISA is working with partners to help farmers build forward market linkages with maize mills as an enabling factor for intensification and income generation.

More than financial profits, the women farmers were pleased that they could provide nutritious food for their children during the lean season from August to October, when grain stores from the previous cropping season have usually been used up.

While the sale of green cobs can be remunerative for these communities, it is a perishable commodity that cannot be stored and local markets often become saturated, leading to lower prices and distress sales. At the regional scale,





there are large markets for dry grain among feed and food millers, who source maize in bulk and not from individual farmers.

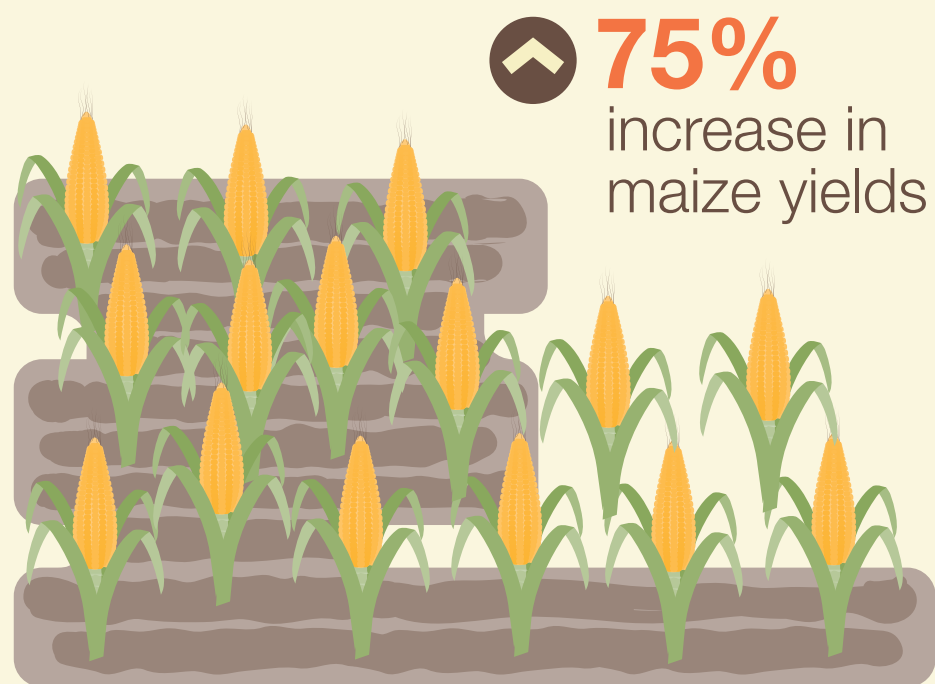
CSISA is helping by linking these tribal farmers with new and established markets for maize grain through organizing community consultations with representatives of poultry feed mills in the predominantly tribal belt of Mayurbhanj.

### RESEARCH RESULTS

The results of five years of research at CSISA's Karnal Research Platform demonstrate that Kharif maize is a suitable and profitable alternative to rice in the rainy season in northwest India to address issues of scarcity of water, labor and energy in the region.

### IMPACT IN NUMBERS

Maize yield increased by nearly **75 percent** with the use of hybrids, under line sowing and improved agronomy in Mayurbhanj, Odisha.



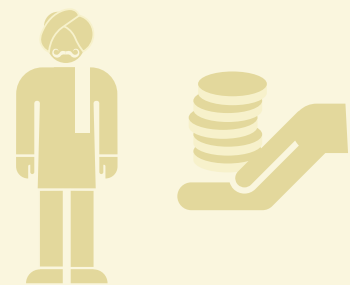
## Partnerships Support Expansion of Conservation Agriculture

"Conservation agriculture is all about savings," said Sunderaj, a farmer in Thiruvaiyaru, a village in Thanjavur district in Tamil Nadu. Sunderaj was thinking about quitting agriculture before he learned about practices such as direct seeded rice and laser land levelling. In 2014, using these practices with support from CSISA, Sunderaj's yields went up from 4 to 6 tons per hectare, even though he used 50 percent less water and was able to save 45 percent on fertilizer, seeds, tillage and other costs. His confidence in the profitability of agriculture has been restored.

To expand conservation farming methods among more farmers like Sunderaj, CSISA has developed strong strategic partnerships and built the capacity of key partners including the Department of Agriculture, Tamil Nadu Agricultural University, MS Swaminathan Research Foundation and Reliance Foundation. These partnerships have helped generate awareness and increase the adoption of improved agricultural practices in Tamil Nadu. As a result, the Tamil Nadu Department of Agriculture has now recommended that farmers use machine drill seeding for rice in the Cauvery Delta region and distributed a direct seeded rice manual to farmers to support its expansion.

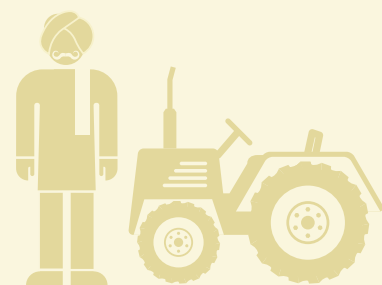
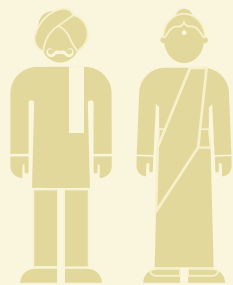
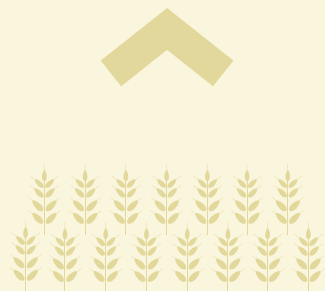






## Fostering Rural Entrepreneurs

# BIG BUSINESS IN MECHANIZING SMALL FARMS



Barsaprasad Hembram, a maize farmer from Mayurbhanj district, Odisha, purchased a variety of modern farm machines last year through a government scheme that gives farmers a 50 percent subsidy on tractors and auxiliary implements such as the seed drill. Today, Hembram uses his new farm equipment to provide agricultural custom-hire services to other farmers, charging US\$ 14.35 per hour for the tiller. Not only does this service give Hembram additional income, it helps other smallholder farmers who cannot afford to buy machines on their own to reap the benefits of modern farming technologies.

India has a large number of smallholder farmers with less than 2 hectares, especially across eastern India, where the average landholding size is decreasing and ownership of machines by smallholder farmers is often not economically viable. To help bridge the gap between the demand for new technologies and the supply of those services, CSISA focuses on strengthening networks of service providers (SPs).

The concept of custom-hire service began evolving as farmers purchased conservation agriculture machines including zero-till seed drills, laser land levelers, rice transplanters, bed planters and threshing machines.

During the last three years, CSISA has facilitated more than 1,900 progressive farmers in Bihar, eastern Uttar Pradesh and Odisha to become SPs and has been building their capacities through trainings on relevant knowledge and skills, such as conservation agriculture, small-scale machinery, business development services and financial



By empowering service providers with technologies that have a strong business case at every step along the value chain, CSISA works to facilitate the uptake of sustainable technologies that would otherwise be beyond the reach of most smallholder farmers.

management to help them track their income, expenditures and hectares serviced. After creating a network of SPs, CSISA links them with the State Department of Agriculture and a variety of important private sector actors.

CSISA's survey of service providers in Bihar and eastern Uttar Pradesh found that subsidy-based interventions helped farmers acquire new machines, but often farmers' lack of knowledge on how to use the machines forced many to abandon them. In this scenario, a strong network





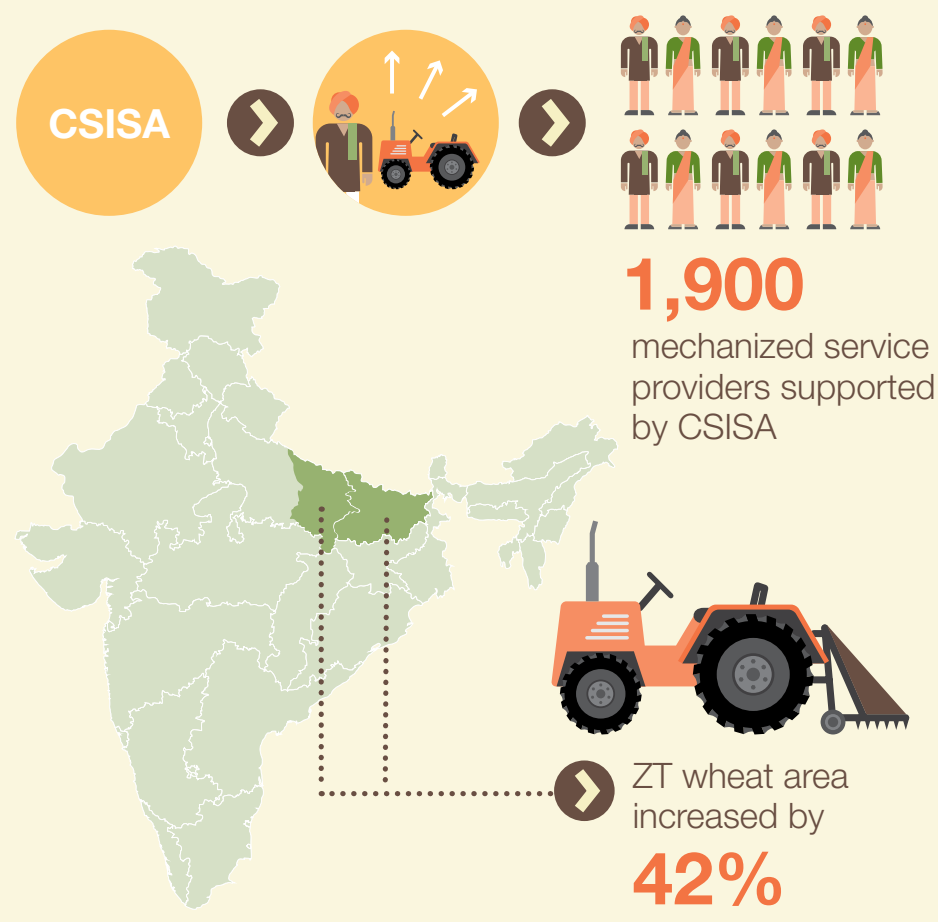
of SPs, enables farmers to adopt mechanization not only to intensify their cropping systems but also to improve their productivity by undertaking the timely sowing and harvesting of crops.

The survey also showed that SPs are well-positioned to deliver new technologies in part because they represent the same communities they are serving and because they can reduce the transaction costs associated with adopting new technologies.

### ➤ IMPACT IN NUMBERS

CSISA supports a network of more than **1,900 mechanized service providers** across India.

Across Bihar and eastern Uttar Pradesh hub districts, over **50,000 hectares of ZT wheat** were sown by CSISA-supported service providers in 2013-14, reflecting an **area increase of 42 percent** over the previous year.



## Smart Tools for Farmers Help Increase Yield

CSISA, in collaboration with the International Rice Research Institute and state universities and government partners, has developed localized versions of the 'Crop Manager' decision-making tool to provide location-specific fertilizer recommendations for farmers growing rice and maize in Odisha and rice-wheat and maize in eastern Uttar Pradesh. In the Cauvery Delta of Tamil Nadu, a version of 'Nutrient Manager for Rice' has been developed by CSISA to support and complement the existing crop management advisory services of the state government.

Orissa University of Agriculture and Technology (OUAT) has endorsed the Rice Crop Manager and will be extending its recommendations to the farmers through their network. The tool includes both a web-based and mobile Android application with a simple, user-friendly interface providing personalized fertilizer guidance (optimum amounts of nitrogen, phosphorus and potassium) for critical growth stages of the plant in order to increase yield and profit.





## Direct Seeded Rice

# COST-EFFICIENT PLANTING INCREASES FARMERS' PROFITS

The dry direct seeded rice (DSR) method is gaining popularity in Bihar, Haryana, Odisha and Tamil Nadu, thanks to the researchers, agricultural departments and enterprising farmers who have tested and implemented this new technique. Faced with threats of depleting groundwater, shortages of farm labor, rising production costs and climate variability, more farmers are adopting DSR, which can be both environmentally friendly and cost efficient.

DSR involves sowing seeds directly into the soil using a machine called a seed drill and provides an alternative to the traditional practices of germinating seeds in a nursery and then transplanting seedlings into the field, or broadcasting, in which rice seeds are tossed by hand onto the soil surface. DSR with line sowing can substantially improve the productivity of rice. It brings many benefits to farmers — reduces cultivation costs by US\$ 90 per hectare and reduces water consumption by 25 percent.

To increase DSR adoption among farmers, CSISA has worked with the state agriculture departments, state agriculture universities and other partners to conduct technical trainings on DSR for farmers and service providers. CSISA, in partnership with Tamil Nadu Agriculture University, organized a season-long direct seeded rice course over a period of five-and-a-half months to provide a comprehensive training for the state extension system of Tamil Nadu, covering all aspects of growing drill-seeded rice, from crop planning to milling and processing.

CSISA researchers continue to improve access to effective weed management and affordable herbicides for direct seeded rice to help achieve increased adoption of this technology at a larger scale.

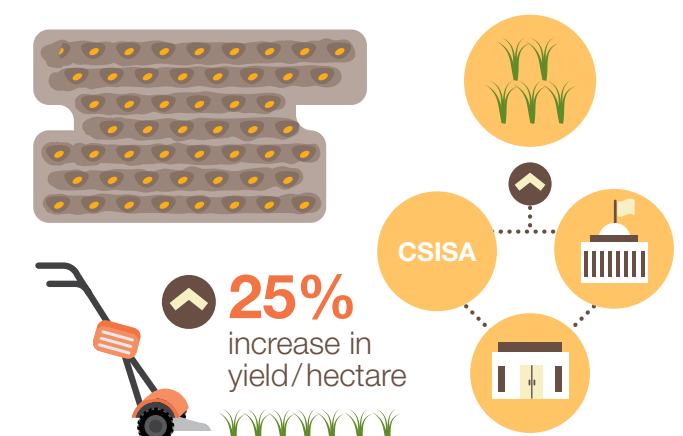


Research indicates that DSR is effective in reducing emission of methane, a potent greenhouse gas that contributes to global warming. For each ton of rice production with conservation agriculture practices, on average 400 kg CO<sub>2</sub> equivalent was reduced compared to conventional puddled transplanted rice.

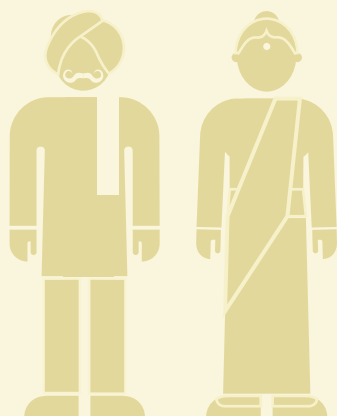
## ➤ IMPACT IN NUMBERS

Direct seeded rice with line sowing improved the rice yield by over **25 percent per hectare** in Odisha.

Higher yields with reduced production cost increased the net profit for farmers by up to **US\$ 72 per hectare**.







## Improved Livestock Feeding

# ENHANCING INCOME AMONG DAIRY FARMERS

Anuj Kumar Jha, a young farmer from Samastipur district in Bihar, had 0.2 hectare of agricultural land but was unsure what to do with such a small parcel of land. With CSISA's support he learned that with a small investment he could start a dairy business.

Jha bought a crossbred cow for US\$ 377, which initially yielded about 12 liters of milk per day. After receiving training from CSISA, he started giving a balanced concentrate feed prepared using locally available materials, which increased the cow's milk yield to 18 liters per day. Motivated by his success, Jha bought three additional cows and today, he owns more than 20 crossbred dairy cattle. With steadily rising demand for milk in Bihar, Jha is able to tap into this expanding market for augmenting the household farm income.

CSISA is helping farmers like Jha become more aware of improved feeding practices, livestock health management and animal nutrition to improve the yield and quality of milk. Traditionally, farmers were feeding their animals unchopped paddy straw, as well as maize leaves, which are difficult for the animals to digest.

Over the past three years, CSISA, through the International Livestock Research Institute, has addressed major livestock feed constraints by introducing practices that improve the efficiency of rice and wheat straw feeding through chopping, increase the use of inexpensive, locally available and nutritionally rich supplementary feeds such as maize grains and by promoting underutilized cereal residues such as maize stover. The field-based work has been complemented by laboratory-based research, which has identified more than 24 improved cereal crop varieties that are good for both grain and fodder quantity and quality.

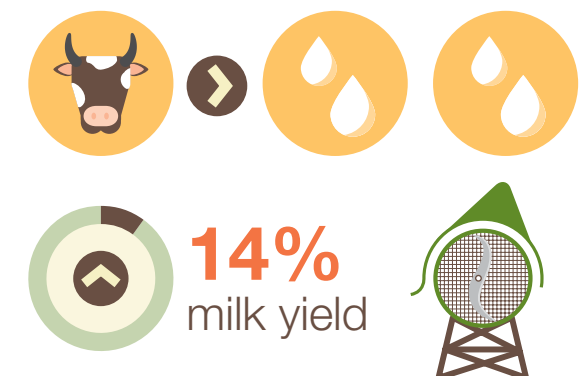


The development of local service providers for straw chopping and concentrate feed production provided a new business opportunity and improved availability and access to better feed for dairy farmers.

## ➤ IMPACT IN NUMBERS

Milk yield **increased by at least 10 percent** when farmers increased the use of inexpensive, locally available and nutritionally rich supplementary feeds.

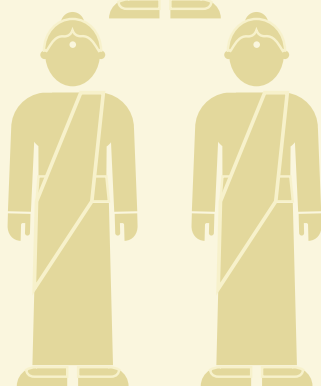
Use of chopped fodder to feed livestock increased the milk yield by **14 percent** for dairy farmers in Odisha and Bihar.





## Reaching Women Farmers

# BETTER ACCESS TO AGRICULTURAL INFORMATION AND TRAINING



On a hot summer day in Muzaffarpur district of Bihar, around 60 women farmers gathered to learn about the handheld mechanical maize sheller that would liberate them from the painful and tedious practice of shelling maize by hand. The women were enthusiastic and spoke confidently. Bholi Devi, one of the group members, said, “Learning new ideas and people approaching us with new knowledge on agriculture has increased our confidence.”

CSISA works to empower women in agriculture by ensuring their access and exposure to modern and improved technological innovations, knowledge and entrepreneurial skills that can help them become informed and recognized decision-makers in agriculture.

In Bihar, CSISA started Kisan Sakhi (roughly translates to farmer friend), jointly with Bihar Mahila Samakhya, an Indian Government program on rural women’s empowerment. Thanks to the Kisan Sakhi initiative, many women farmers like Bholi Devi were introduced to new practices such as improved weed management, maize intercropping, intensification of cropping systems with summer green gram, machine transplanting of rice under non-puddled conditions and nursery management. Notably, CSISA also helped a women’s group in Muzaffarpur become mechanized service providers for rice planting — the first entrepreneurs of their kind in Bihar.

In Odisha, CSISA has engaged with women’s self-help groups (SHGs) and their federations to undertake participatory technology



In Odisha and Bihar, CSISA has leveraged the social capital of the many women’s self-help groups that have been formed by the government and other civil society partners. These groups have provided readymade entry points for training and social mobilization, while also providing other antecedents for innovation including access to credit.

testing and dissemination. As a result of this collaboration, and through Kisan Sakhi in Bihar, more than 1,500 women farmers tried at least one improved technology on their land during 2013-14.

## ➤ IMPACT IN NUMBERS

More than **2,500 women** members of different **self help groups** have been trained on a variety of relevant improved technology and practices.



**2,500**  
women farmers  
trained



## Strategic Research Builds Evidence Base

CSISA has focused its strategic research on sustainable intensification to inform and improve labor-, energy- and water-saving conservation agriculture practices and crop diversification. Conducted at two platform sites in India representing distinct agro-ecologies: Karnal, Haryana and Patna, Bihar, these on-farm and on-station research results have significantly influenced CSISA's outreach to farmers over the past three years.

- Kharif Maize has been demonstrated to be a more suitable and profitable alternative to rice in the rainy season in northwest India to address the issues of rising scarcity of water, labor and energy in the region.
- Mustard is a viable third crop option for diversification in the Rabi season in eastern India, which also allows 300 percent cropping intensity as spring season maize can be planted after the mustard harvest.
- As part of the sustainable intensification effort, short duration rice hybrids followed by long duration wheat led to higher system productivity and also acts as a guard against climate change. It enables system intensification of 200% (in rice-wheat) and 300% (in rice-mustard-spring maize or mung bean).



Shorter duration rice enables rice-wheat system intensification of **200%**

## Influencing Policies for Improved Agricultural Growth

Well-structured public policies can incentivize smallholder farmers, rural entrepreneurs and consumers toward choices that improve welfare, enhance yield and are environmentally sustainable. CSISA, through the International Food Policy Research Institute, developed a critical mass of research needed to promote an actionable and evidence-based agenda for improving public policies to address South Asia's cereal systems.

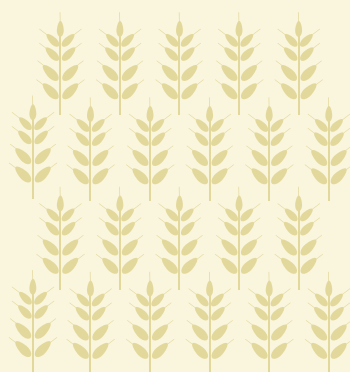
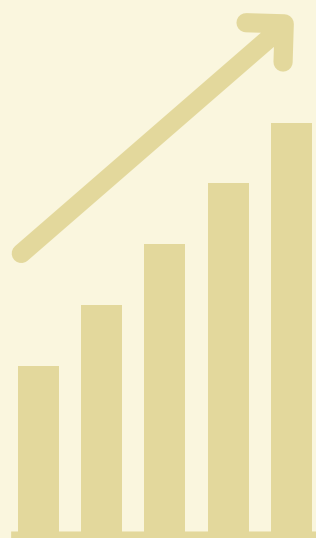
CSISA's policy work has strengthened the quality of the debate around seed systems development in the region through analysis of rules and regulations governing the seed market and the roles for public and private investment. Similarly, it has tackled the question of input subsidies and their impact on sustainable intensification. For example, it looked at the economic and environmental trade-offs associated with poorly targeted subsidies for laser land leveling in eastern Uttar Pradesh and provided the state government with alternative strategies for improving the efficiency of these subsidies. CSISA has also worked to improve extension models to ensure that they are site-specific, tailored to different groups, such as women farmers and include opportunities to reach smallholders at a large scale.





## Postharvest Mechanization

# REDUCING LOSSES, INCREASING PRODUCTIVITY



In India, farmers with large landholdings from prosperous agricultural states like Punjab can buy expensive and sophisticated machines for farm operations. However, resource-poor farmers with smaller landholdings from states such as Bihar may not have funds to buy these machines.

CSISA has been working to ensure that farmers all along the spectrum of landholdings have access to differently priced and scale-appropriate machinery based on their specific requirements. CSISA has also helped improve existing designs of harvest and postharvest machinery to better meet local needs.

For rice, mechanized threshing offers many advantages over manual threshing in terms of increased efficiency, reduced drudgery, cost and labor savings. Until recently, farmers in Bihar only had two options to choose from – the very large and expensive axial flow thresher or the compact pedal-powered open drum thresher that has low capacity and is difficult to operate for long periods by women farmers, who are responsible for most threshing activities in India. The only medium-sized option was an electric motor powered open drum thresher available from other states, which was not effective as many farms in Bihar do not have reliable access to electricity. Farmers needed a medium-sized, affordable, efficient and portable mechanical paddy thresher. CSISA worked with a local fabricator to modify the existing design and created the diesel engine powered open drum thresher, which farmers could easily buy and use.



**M**arginal farmers usually harvest and thresh manually to get full-length straw for fodder. Manual threshing involves significant drudgery, creates bottlenecks for planting the next crop and generates losses from delayed processing. CSISA worked to modify threshers to meet the farmers' needs resulting in an increased customer base for service providers.

Similarly, in collaboration with local dealers, CSISA worked to modify the existing mechanized maize sheller to an electric motor-powered double cob maize sheller, which can shell 150 kg maize per hour and consumes only 2–4 units of electricity. Priced at US\$ 126, the machine is also fairly affordable. CSISA worked with partners to bring down machinery costs through diversifying the number of manufacturers and encouraging competition.

## ➤ IMPACT IN NUMBERS

Mechanical paddy threshing in eastern Uttar Pradesh **reduced postharvest losses by 3 percent** compared to manual threshing, helping advance wheat sowing by 9 days.





## New Varieties

# DEVELOPING BETTER RICE AND WHEAT

Asia faces multiple challenges to ensuring food security, including dwindling water supplies for irrigation, changes in urbanization patterns and a growing threat of increased virulent diseases. Improved rice and wheat varieties can play a major role in ensuring food security and combating these challenges by developing superior cultivars with good quality traits and genetic resistance to biotic and abiotic stresses.

CSISA-supported rice and wheat breeding work from 2012 to 2015 helped to produce new varieties and hybrids with high yield potential, region-specific grain quality traits, biotic and abiotic stress-tolerance and suitability for different cropping systems. These have been shared with the national agriculture research and extension systems (NARES) and many of these elite breeding lines are currently in advanced stages of testing in multi-location trials at state and national levels.

CSISA is also working to improve faster dissemination of superior, disease-resistant and stress-tolerant varieties to farmers. In the last year alone, 12 wheat varieties were released, as part of CSISA's breeding work, for different environments and management conditions of South Asia. Out of 60 rice entries tested during the 2014 dry season under machine-sown dry direct-seeded rice, 15 entries recorded more than 7.5 tons per hectare. These improved varieties are often more profitable for resource-poor farmers and are one of the most effective adaptive strategies for events associated with climate change in South Asia.





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## ABOUT CSISA

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The Cereal Systems Initiative for South Asia (CSISA) works to reduce hunger and increase food and income security of resource-poor farm families in Bangladesh, India and Nepal through the accelerated development and inclusive adoption of new cereal varieties, sustainable agricultural management technologies and policies.

[www.CSISA.org](http://www.CSISA.org)



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