ICRISAT DEVELOPMENT CENTER

IMPACT

Stories of scale-up in agri-science

November 2020 | No. 3

Photo: A Seshadri, ICRISAT

Photo: ICRISAT

Beneficiaries of Bhoosamrudhi produce Direct Seeded Rice (left) and groundnut (right).

Bhoosamrudhi brings science to Karnataka's farms, prosperity follows

500,000 farmers in 640,000 ha increased their yields by 15% to 40% and generated benefits worth US$ 15 million in six years

Farmer Anji Reddy had no idea what mulching or covering the soil surface could do. When he attempted it, he was pleasantly surprised to see reduced weed growth. The icing on the cake, however, proved to be the 33% yield increase he saw in capsicum crop. The jump in yield helped him net ₹ 40,000 more even as he saved ₹ 15,000 that would have been needed for weed removal. He is one of the farmers in the Bhoosamrudhi Project.

"I planted capsicum on 0.8 hectares (2 acres) in 2019. I was advised by the Bhoosamrudhi-ICRISAT staff to mulch the topsoil with plastic. It did wonders! I harvested 3 tons. Earlier, yields wouldn't exceed 2 tons," Mr Reddy, a smallholder farmer in Rajgira village in Karnataka's Bidar district, beamingly said.

Bhoosamrudhi – how it came to be and its focus areas

Fifty-six percent of Karnataka's population depends on agriculture for livelihood. Many of the state's farmers toil in drought-prone areas with sporadic patches of irrigated areas. A large portion of agricultural land in the state is exposed to vagaries of monsoon and severe agro-climatic and resource constraints.

Inside

These factors led Government of Karnataka's Department of Agriculture (DoA) to adopt science-led initiatives for achieving impactful development in the state. The Bhoosamrudhi project was coordinated by ICRISAT and executed by a consortium of six CGIAR centers, NARS partners and line departments of the state government across eight districts in Karnataka from 2013 to 2019.

The focus areas of the project have been – use of efficient land management technologies, improved cultivars and improved livestock management practices. These include solar pest traps, weedicide, fungicides, seed dibbling-nipping, fruits and vegetable cultivation promotion, use of drones for mapping and impact assessment, land and water management interventions such as Laser Land Leveling, Broad Bed & Furrow (BBF), Direct Seeded Rice and humic acid – micronutrients, trash shredding, intercrop in sugarcane and tomato, bud chipper, cultivation in rice fallows and more.

Farmers speak

Zero-tillage pulses cultivation in paddy fallows proves lucrative

The family of Mr Krishna from Pejamangoor village survives on paddy cultivation. Bountiful rains in Udupi district, where Mr Krishna lives, ensures high soil moisture during rabi (winter) season. Under the Bhoosamrudhi project, ICRISAT staff advised the farmer to grow black gram and green gram as these crops help improve soil fertility and fix atmospheric nitrogen. He was also advised to try zero-tillage cultivation and sow with a seed cum fertilizer drill. He sowed black gram in 0.40 ha (1 acre) and green gram in 0.40 ha (1 acre).

When used in conservation agricultural practices and in dryland areas, zero-tillage results in high yields and

Growing pulses using zero till cultivation in paddy fallows.

Laser land leveler at work.

reduced per hectare production cost compared to conventional tillage. Zero-tillage follows three principles: (a) continuous no-till, leaving high stubble standing (also creating soil health conditions that in medium to long term defeat weeds) (b) permanent soil cover (c) crop rotation. Zero-tillage is known to enhance optimal soil biological, chemical and physical features (including moisture retention).

With the seed cum fertilizer drill machine, Mr Krishna could grow a second crop without tilling the land that in turn resulted in better use of available soil moisture. He harvested 500 kg of both the crops.

"Earlier, with the conventional practices I could harvest only 300 kg in both these crops. Before Bhoosamrudhi, I made no profits from the gram crops. I only cultivated them for increasing soil organic matter, household consumption and to prepare land for next paddy season," he informed.

The extra produce helped him net ₹ 12,000 and ₹ 20,000 from black gram and green gram, respectively. Besides enriching soil, improved practices have helped the farmer earn extra income.

Mr Shivananda from Iduguru village in Chikkaballapura district has seen water run off his fields. Yields in groundnut and other dryland crops were low until the Bhoosamrudhi project.

The project's staff from ICRISAT and CIMMYT noticed that his land was undulated and needed leveling. Laser Land Leveling is a process of leveling slopping land using a guided laser beam throughout the field. After explaining the benefits of laser land leveling that was being taken up under the project, the farmer gave the go ahead. He was also given the groundnut variety ICGV 91114 that he sowed in 1 ha of land.

"My field retains more water now. I received a yield of 650 kg in 0.40 ha (1 acre) against 500 kg during drought years that local varieties give," the farmer said.
He added that the cost of cultivation reduced from ₹ 8000 to ₹ 3000, mainly owing to reduced labor requirement.

The Indian Institute of Horticultural Research (IIHR) and ICRISAT also gave Mr Shivananda Tuberose and China aster seeds free of cost. "I decided to take up floriculture in 0.20 ha (0.5 acre) of land. With China aster, I netted a profit of ₹ 40,000 after spending ₹ 25,000 on cultivation," the farmer said. He is starting to get the first yield of tuberose and is optimistic of high earnings from it.

Another farmer from the same village, Mr Hari Prakash, has a similar tale to narrate. During 2018-19, he incurred a steep cost on cultivation of groundnut. The yield was only 500-600 kg per 0.40 ha (1 acre).

"The Bhoosamrudhi staff noticed issues with my land and recommended that I level it. They suggested laser land leveling," he said. After levelling, he was also given ICGV 91114 groundnut.

"I received 2000 kg per ha. My field earlier could only yield 1200 to 1500 kg. Also, labor costs, after levelling and use of improved variety, were only ₹ 6000 per ha (against ₹ 12,000 earlier)," Mr Prakash said.

Renewable energy wards off pests in Dharwad district

Mr Manjunath Siddalingappa from Kogilageri village grows vegetable and fruit in 1 ha of land. He grows brinjal, tomato, chilies etc. and fruits mango, guava etc. Pests were his bugbear and would set him back by ₹ 9000/per hectare in pesticides every year.

Through the Bhoosamrudhi project, he received a solar light trap free of cost. The light trap is a LED based electro-mechanical device that emits a light of specific wavelength to attract adult insects to the trap. The device runs on sunlight. This has helped Mr Siddalingappa reduce pesticide expense by ₹ 6000 and keep his farm pest-free.

Around 25 farmers in Dharwad have received these traps under the project and have benefited in the same way as Mr Siddalingappa. They have managed to reduced incidence of pest attacks and are easily able to save at least ₹ 5000 per year per ha by way of reduced pesticide use.

Renewable energy wards off pests in Dharwad district.

Benefits from compost culture for groundnut and the advantage of improved safflower varieties

Mr Basavaraj from Chandanamathi village in Dharwad district has about 6 ha of land and usually grows safflower, black gram, soybean and groundnut along with some fodder crops.

"When I noticed that my soil fertility was reducing, I approached ICRISAT and the Department of Agriculture. I was advised to try *Madhyam* culture. They helped me dig a 20 feet pit and trained me to make compost," the farmer said.

Mr Basavaraj received about 15 tractor loads of compost and used it in his field. He saw great success with GPBD 4 groundnut variety after applying the compost.

"I harvested about 3000 kg from 0.80 ha (2 acres). Earlier, I could harvest only 2500 kg. I incurred ₹ 60,000 for cultivating 2 acres and made ₹ 90,000," he said.

PBNS 12 safflower, an improved variety, was given to the farmer. He sowed it in 0.80 ha (2 acres). "My safflower yield increased to 1500 kg with the improved variety while the local variety would yield about 1000 kg. I made a profit of ₹ 20,000," the farmer explained.

He also received 35 kg of safflower cake for every 60 kg bag of harvest after the oil was pressed. He used these cakes along with green fodder to feed milch buffaloes.

"To my surprise, the fat content in the milk had increased. The animals were yielding 30 liters per day. The extra fat helped me earn ₹ 3 more per liter. This translates to a monthly profit of ₹ 3000," the farmer said.

Making compost

1. Any organic waste of plant or animal origin (crop waste, cattle and domestic animal waste, poultry waste, vegetable waste, kitchen waste, food and fruit processing plant waste, sugar factory waste including press-mud, municipal organic waste and other wastes that are organic in nature).

2. Composting microbial culture (Madhyam®, Bioculum® etc.). 1.0-1.5 kg is required per ton of organic material.

3. A shredder cum chipper machine for dry plant waste.

4. Material mixing machine when operation is being done on a large scale (a tractor with a rotator or cultivator attachment is ideal).

5. Urea or nitrogen source when dry plant material is the major waste.

6. Compost nutrient enrichers (rock phosphate, phosphate solubilizers, nitrogen fixers, etc.) if required.

A new way of growing paddy proves remunerative and economical

Cultivation of rice through direct seeding was propagated by IRRI, CIMMYT and IDC.

Direct Seeded Rice (DSR) is grown from seed sown in the field. Traditionally, paddy is cultivated by transplanting of seedlings. DSR helps avoid repeated puddling, prevents soil degradation, matures 10-15 days earlier, saves water by 35-40% and reduces production cost.

Farmers who adopted it with micronutrient application reported 22% increase in yield. Income gains of 15-22% was reported. In Dharwad district, the grain yield for DSR was around 3,900 kg/ha with a net return of ₹ 60,000/ha. Through traditional rice cultivation, yield of around 3,320 kg/ha and a net return of ₹ 52,103 were reported.

In Udupi district, the grain yield for DSR was around 5,360 kg/ha with a net return of ₹ 73,288/ha compared to 5,000 kg/ha with a net return of ₹ 60,237 for rice produced from traditional practice.

To learn more about impacts of land use changes and groundwater management practises, click here to see a recently published research paper on impacts in Kolar.

Project: Bhoosamrudhi

Funder: Department of Agriculture, Government of Karnataka.

Partners: Govt. of Karnataka - Department of Agriculture (DoA), Watershed Development Department (WDD), Department of Animal Husbandry (DoAH), Department of Horticulture (DoH), Department of Rural Development and Panchayat Raj, Karnataka State Seeds Corporation (KSSC); University of Agricultural Sciences, Bengaluru, Dharwad, Raichur; University of Agricultural and Horticultural Sciences, Shivamogga; University of Horticultural Sciences, Bagalkote; Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar; ICAR-Indian Institute of Horticulture Research (IIHR), Bengaluru; BAIF Institute for Sustainable Livelihoods and Development (BISLD); CIMMYT, IFPRI, ILRI, IRRI, IWMI and ICRISAT.

Low cost drought proofing strategies for windfall gains in drylands

POWERGRID-ICRISAT watershed has scale-out potential across India

Water conservation structures in Kurnool watershed – Left: Small farm-pond, Right: Big community pond.

Technologies developed in a national CSR award-winning watershed project in India have helped over 20,000 farmers in southern India conserve 200,000 m^3 of water and earn higher incomes through alternate livelihood options. The project has a scale-out potential of more than 45 million ha in rainfed regions and can double incomes of more than 70 million farmers in India using a holistic and sustainable model. The approach works across agriculture-for-development value chains and was tested in some of the most challenging environments.

The Kurnool story

Andhra Pradesh's Rayalaseema region is no stranger to frequent spells of drought and erratic rainfall that hamper crop productivity and degrade land. Inconsistent incomes cause farmers to struggle, which is magnified by market shocks resulting from fluctuating prices. Additionally, workforce shortage plagues most farms as skilled farm workers migrate to cities for other means of livelihood.

Realizing the plight of smallholder farmers in the region, Power Grid Corporation of India (POWERGRID) supported ICRISAT to improve productivity and livelihoods in a watershed in Kurnool district of the state. The joint endeavor resulted in a model worthy of emulation.

The watershed is located in Bethamcherla mandal/block and comprises four revenue villages viz. Pendekal, Muddavaram, Emboy and Bugganipalli. It is home to around 20,000 people (4100 households) with most households (71%) being small farmers, 20% medium farmers and remaining 9% large farmers. The average annual rainfall in the watershed area is about 675 mm.

Out of a total geographical area of about 6500 ha, around 3000 ha is cultivated. The productivity of the watershed villages' chief crops – maize, groundnut, pigeonpea and sorghum – is low.

The watershed way

Increasing rainwater storage reduces yield losses

Rainwater conservation in the POWERGRID-ICRISAT watershed has generated an additional water storage capacity of more than 200,000 m^3 (Figure 1a). Smallholders were able to plug yield losses by 30-60% thanks to 150 small farm-ponds that improved water access.

For the project's efforts, the President of India awarded the POWERGRID-ICRISAT watershed projects in Kurnool, Andhra Pradesh, and in Vijayapura, Karnataka, the National CSR award for exemplary work towards integrated water management and community development.

A beneficiary from the project has set up her own store to sell stationary and snacks.

Smallholder's ability to invest in intensification and diversification, vegetable cultivation and planting fruit plants in marginal lands increased. In turn, the system productivity and profitability rose. Before the watershed, farmers were able to have only one harvest season. Now, they harvest twice in a year.

Water harvesting structures prove cost effective

The low cost of investments in masonry work in ponds helped benefit maximum number of farmers. Apart from the farm ponds, big community ponds and other water harvesting structures proved effective in increasing water availability and irrigation area by around 25%. The farmers not only increased productivity, but also increased area under high value crops.

Tank rejuvenation shows small efforts can yield big

In Veeraiapalli village, a percolation tank having 58,700 m^3 capacity was rejuvenated by creating bunds of 144 m length. This has resulted in 5.8 ha water spread with an average depth of 1 m. As many as 1200 *Gliricidia* plants have been planted in the periphery to help protect the bunds.

This intervention has brought respite to farmers of Veeraiapalli and neighboring Repalli village, especially in times of drought. Now, the water is retained in the area and provides drinking water for a large livestock population of over 1000 animals in these villages.

That apart, before the bunds and stone pitching works, water retention was minimal and surface run off was high. Ever since the intervention, farmers from the two villages are able to use water from the tank for spraying mango saplings during critical growth stages and for other rainfed crops like pigeonpea.

Holistic scaling-out through an integrated approach

The diagnosis of widespread micronutrient deficiencies in farmers' fields (Figure 1) warranted need-based inputs that resulted in improvements of 10-50%. Similarly, productivity was improved with improved crop varieties. With better water and soil resources, farmers, including women, were able to improve livelihoods through activities like fodder promotion and livestock related activities, kitchen gardens for household nutrition and other income generation activities. The integrated and holistic solutions adopted make the watershed a scalable site for doubling incomes. Learnings from the project need to be scaled-out to other parts of drylands to benefit smallholders.

Click here to view the impacts of the watershed.

Project: Improving Rural Livelihoods through Farmer-centric Integrated Watershed Management

Funder: Power Grid Corporation of India Limited

Partners: NGO (RSDS), Department of Agriculture, Andhra Pradesh and ICRISAT.

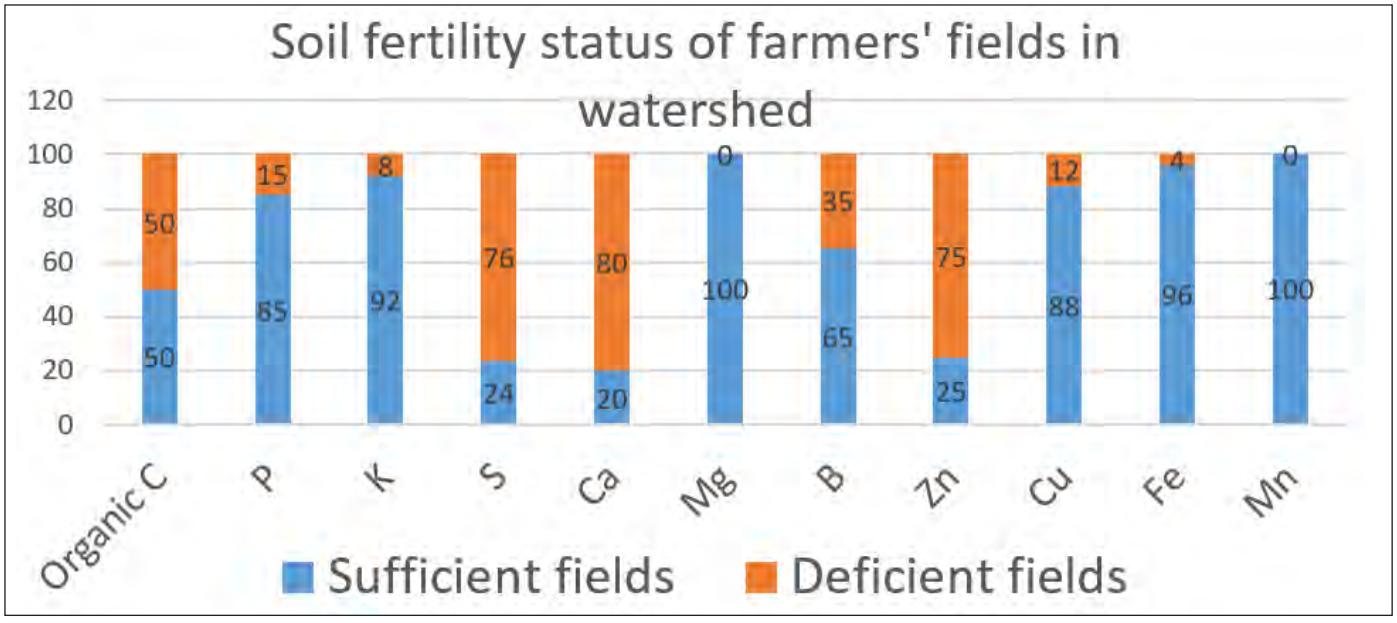

Fig 1. Soil fertility status of farmers' fields in Kurnool watershed.

Modern soil testing labs to give farming in Odisha a big boost

To improve agricultural productivity by detecting soil nutrient deficiencies and remedying them, two state-of-the-art soil testing laboratories in Bhubaneshwar and Sambalpur are being set up and have begun dry runs. The referral laboratories are being set up in a convergence mode, with ICRISAT supporting the government laboratory staff for a period of one year to make them self-reliant in running the laboratories. These labs will serve as nodal agencies and strengthen the state's initiative to provide farmers soil health cards.

The need for soil testing

Without good soil, a farmer's crop will usually fail or yields will be low. It is well known that the semi-arid tropics in India have degraded soils due to weathering, lack of moisture, poor nutrient management, overuse of chemical fertilizers, etc.

In Odisha under the Bhoochetana Project, 40,000 soil samples from across 30 districts were analyzed. The exercise revealed widespread zinc and boron deficiency.

Based on learnings from remedies that were piloted in the state, it was estimated that if improved nutrient management is scaled out to even 50% of the cultivated area, the state's agricultural productivity will increase by at least 10%.

Genesis of referral labs under Odisha Bhoochetana

Odisha government reviewed the status of soil testing labs in the state and collaborated with ICRISAT for transforming laboratories in Bhubaneshwar and Sambalpur into referral laboratories for the state. ICRISAT, which has been implementing the Bhoochetna project with the government, has a state-of-the-art laboratory, the Charles Renard Analytical Laboratory (CRAL), for soil, plant and water analysis in Hyderabad. CRAL is one of the two laboratories in India accredited by the FAO's Global Soil Laboratory Network (GLOSOLAN).

Hands-on training conducted for soil testing laboratory staff of Odisha at ICRISAT in the year 2018.

Getting soil labs running during a pandemic

The referral labs will cater to Odisha's need for analyzing a large number of soil, water, fertilizer and plant samples in a short time. The laboratory staff will be trained according to international guidelines for conducting analysis in the long run which will leverage the whole soil health management system.

> "Each lab started dry runs for a few parameters. Necessary equipment and chemicals for testing about 10,000 samples for 15 parameters have been made available in each lab by CRAL staff, notwithstanding COVID-19 pandemic, by following distancing and sanitization protocols."
>
> *– Dr Pushpajeet Chaudhari, Manager, CRAL*

Project: Enhancing Agricultural Productivity and Rural Livelihoods through Scaling-up of Science-led Development in Odisha: Bhoochetana

Funder: Department of Agriculture, Government of Odisha

Partners: Odisha University of Agriculture & Technology; NGOs (CARR, Abhyudaya, HAVL, NJS, Sambandh, APOWA, Triranga Yubak Sangha, SEWAK, Mahashakti Foundation, Pragati, Parivartan, Loksevak, Harsha Trust, Foundation for Ecological Security, UDYAMA, NIRMAN, SGF, NIRDES, Jankalyan Pratishthan, Lokadrushti); and ICRISAT

CGIAR research pays off: New report finds 10 times return on investment

Investments in CGIAR research generate returns of 10 times the amount invested, a new report has found. The report, commissioned by the Supporters of Agricultural Research (SoAR) Foundation, found a 10 to 1 benefit-cost ratio on CGIAR investments of $60 billion in present value terms over almost five decades.

Titled *The Payoff to Investing in CGIAR Research*, the report was co-authored by Julian M. Alston at the University of California, Davis; Philip G. Pardey at the University of Minnesota; and Xudong Rao at North Dakota State University.

The researchers found that not only did CGIAR research deliver high returns, but that the organization was uniquely positioned to benefit smallholder farmers and protect food systems through embedded partnerships in low-income countries. They noted that additional investments in CGIAR can be expected to perform exceptionally well, and urged accelerated funding for CGIAR to meet the world's goals on ending poverty and hunger.

"This work by esteemed economists exemplifies the continued need for increased investment in agricultural research across the globe," said Thomas Grumbly, president of SoAR. "Farmers everywhere need new innovations to be able to adapt to the effects of climate change, while still feeding their communities and the world."

In some cases, CGIAR's return on investment could be more than double the overall estimate, the report notes. The 10-to-1 estimate reflects the median value of return on investment, whereas the mean in calculations came closer to 25 to 1.

Despite the high rate of return, international agricultural research – including that conducted by CGIAR – remains severely underfunded. This poses threats to food, economic and environmental security, and risks worsening poverty and hunger globally.

The challenge of achieving the global Sustainable Development Goals (SDGs) is at risk. After decades of progress, global hunger and malnutrition are again on the rise. Increased cost of food, extreme weather events due to climate change, and now the global COVID-19 pandemic have brought the world further from its goal of ending hunger by 2030.

The highest rates of hunger are occurring in areas where the majority of people depend on agriculture for their livelihoods, often as smallholder farmers. Strengthening smallholder agriculture will be essential to protect food systems globally, the report finds.

International research and development focused on food, land and water systems, and conducted in close collaboration with local partners, equips smallholders with innovations that can help increase their income, feed and nourish their communities, and protect the natural environment, while adapting to climate change.

Yet recent findings from the Ceres2030 international research consortium show that studies related to smallholders make up a minority of agricultural research publications – with CGIAR research as a notable outlier.

CGIAR's work to improve crop and breed varieties, advise on farming management practices, provide policy recommendations and other innovations resulting from research, has made significant contributions to reducing hunger and malnutrition globally, while delivering economic benefits to the world's most vulnerable.

Its partnerships in low-income countries, including with governments, universities, farmers and the private sector, are a considerable asset in the development, distribution and scaling up of its impactful agricultural innovations.

Recognising the increasing urgency of its mandate, CGIAR brings together its capabilities, knowledge, assets, people and global presence, aiming for greater integration in the face of the interdependent challenges facing today's world. As One CGIAR in a unified system, it is pursuing a revised mission to "end hunger through science and innovation to advance food, land, and water system transformation in a climate crisis", focusing its efforts on the five key impact areas of nutrition, poverty, gender, climate, and environment.

The SoAR report urges accelerated and increased funding to make this work possible, and to assist the world in achieving its goals to end hunger and achieve the ambition of the SDGs.

UP agriculture minister reviews DFI project, visits Chitrakoot site

The minister's field visit to a Haveli in Chitrakoot project site.

A farmer displaying the inputs she received for her wheat field under the DFI project

Mr Surya Pratap Shahi, Minister of Agriculture in Uttar Pradesh state's government, reviewed the progress of the Doubling Farmers' Income (DFI) project in the state's Bundelkhand region. The minister praised the concept of renovating traditional water tanks *(Havelis)* renovation and appreciated efforts of all partners and project team members.

Mr Shahi encouraged the team to complete the remaining Natural Resources Management (NRM) activities. Dr Ramesh Singh, Principal Scientist, IDC, who participated in the review meeting, assured the minister the work is on course for completion within a year. The minister also discussed the idea of scaling-up the interventions across Bundelkhand as a drought-proofing strategy.

The DFI project in Bundelkhand region, funded by the Uttar Pradesh government, has moved forward at a rapid pace since its inception. The partners in the project are improving rainwater harvesting through construction of check dams, farm ponds and renovation of *Havelis*, desilting of water harvesting bodies and large-scale field bundings in seven pilot sites of the region. The minister visited one of the project sites in Chitrakoot district.

Thirteen renovated *Haveli* structures are harvesting 50,000 to 200,000 m^3 capacity. Twenty other masonry structures including village ponds and check dams with a capacity of 5000 to 20,000 m^3 were also constructed. As much as 2 million m^3 rainwater harvesting capacity has been developed. This is facilitating more than 5 million m^3 groundwater recharge and has helped about 5000 farming families.

The DFI has identified scope for construction of more than 10 *Haveli* structures within the Chitrakoot pilot site. The farmers there have also expressed their keen interest in the proposal and agreed to take active part in the renovation.

Project: Doubling Farmers' Income in Bundelkhand Region, Uttar Pradesh

Funder: Government of Uttar Pradesh

Partners: ICAR-CAFRI, ICAR-IGFRI, BUAT, BAIF, Bharat Agriculture, Lakshya Seva Samiti, Gram Unnati, Samarpan, Jan Kalyan Samiti, Samarth Foundation, Gram Unmesh Sansthan, Gramin Vikas Kendra, Upman Mahila Samstan and ICRISAT

Revival of old water resources for better farm livelihoods

A water tank's renovation in one of India's most drought-prone regions benefited as many as 200 farm families last year and opened up aquaculture opportunities for an entire village. It also helped create a storage capacity of about 25,000 m^3. The tank filled multiple times during last year's monsoon and provided more than 100,000 m^3 cubic meter of surface water. This facilitated groundwater recharge in the village, renewing defunct tubewells that supplied water for domestic and farm use.

"Before the tank was renovated, our tubewells could supply water only two hours a day. This year, even in the summer, we had continuous supply. We did not take water from the tank as the tubewells located close to our fields provided plenty of it," said Mr Ramlakhan Nishad, a farmer of Devara village in Bundelkhand region of the Indian state of Uttar Pradesh.

The Devara tank benefited all villagers equally irrespective of the location of their farm with respect to the tank, Mr Nishad added. Farmers in Devara mainly cultivate wheat in winter.

Working with its partners in the Doubling Farmers' Income project, ICRISAT restored the village tank by desilting and construction of a masonry outlet in May-June 2019.

Additionally, large scale field-bunding around the village tank helped enhance soil moisture in the fields and reduce sedimentation load, which is essential for long term sustainability. Rejuvenating the village tank also led to starting of aquaculture. The water body has become a place for worship during community gatherings and a recreational site for children. With monsoon arriving on time this year,
Mr Nishad said his village has more reasons to cheer. Several such tanks are being restored across the region under the project.

The Devara Tank in Banda district of Uttar Pradesh.

To know more about building climate resilience, click here to see a research paper on the work in Bundelkhand.

Project: Doubling Farmers' Income in Bundelkhand Region, Uttar Pradesh

Funder: Government of Uttar Pradesh

Partners: ICAR-CAFRI, ICAR-IGFRI, BUAT, BAIF, Bharat Agriculture, Lakshya Seva Samiti, Gram Unnati, Samarpan, Jan Kalyan Samiti, Samarth Foundation, Gram Unmesh Sansthan, Gramin Vikas Kendra, Upman Mahila Samstan and ICRISAT

Grafted vegetables help farmers reap rich harvests

Mr Chowdappa, a farmer from Ramkuppam village in southern India, increased yield of bottle gourd by a third by simply planting a grafted variety of the vegetable. The switch to grafted vegetables helped him and over 400 farmers significantly increase income without much effort.

"Last year, I cultivated 1500 seedlings of grafted bottle gourd in half-acre area. Despite the uncongenial weather due to unseasonal heavy rains, the crop growth and vigor was very good. The yield was better than non-grafted varieties. I harvested 20 tons of grafted bottle gourd against 15 tons the regular seedlings would yield," the farmer Chittoor district said.

At the Centre of Excellence for Vegetables and Flowers in Kuppam, Chittoor, farmers are trained in basics of vegetable grafting of solanaceous crops such as tomato, capsicum, chili and cucurbitaceous crops like bitter gourd, cucumber and snake gourd.

The initiative was taken up by ICRISAT Development Centre (IDC) in collaboration with Department of Horticulture, Andhra Pradesh, the state where Chittoor is, and Heirloom Seedlings and Plants Pvt. Ltd. The initiative aims to double farmers' income through grafted vegetables.

Public-Private Partnership to double farm incomes through grafting

ICRISAT and its incubating private partner, Heirloom Seedlings, conducted studies for more than three years and screened various rootstock-scion combinations in solanaceous and cucurbitaceous vegetable varieties existing in India. The grafting technique that is being employed was developed by the World Vegetable Center.

As vegetable grafting is an innovative and sustainable approach to address soil-borne diseases, the horticulture department felt necessary to introduce this technology and popularize it among small and marginal vegetable growers in the state. The department is subsidizing farmers' purchase of seedlings.

IDC provides technical support and trains farmers in growing grafted seedlings along with scaling up and developing the technology. Training focusses on grafting principles and protocols, selection of rootstocks, different types of grafting methods in vegetables and post-grafting protocols to be followed along with agronomical practices.

Farmers cultivating grafted vegetable are reporting yield advantage ranging from 30% to 50% in addition to overcoming biotic and abiotic stresses viz. bacterial wilt, *fusarium* wilt, nematodes, salinity etc. by using grafted seedlings.

"I received a bumper tomato yield of about 38 tons. The crop has higher longevity than non-grafted plants. Farmers in the region usually harvest around 30 tons per acre from non-grafted tomato seedlings," said Mr Mohan Reddy from Chowdepalli village, who has 8 hectares (20 acres) and grows tomato, beans and flowers. He cultivated grafted tomato in 1 acre (0.40 ha).

Farmer Damodar Raju narrated, "I received 1000 saplings of grafted chili from the Centre of Excellence. The grafted seedlings gave me 400 kg yield, about 100 kg more than non-grafted chili, from 0.08 ha (0.2 acres). The chilies had better size and color compared to non-grafted variety."

Project: Doubling Farmers' Income through Grafted Vegetable Seedlings in Andhra Pradesh

Funder: Government of Andhra Pradesh

Partners: Department of Horticulture AP, Heirlooms seedlings Pvt. ltd and ICRISAT

What is grafting?

Selection of scion | Selection of root stock | Insertion of scion and rootstock in tube | Grafted seedling

To learn more about impactful approaches, see the last issue here

Contributor: Arun Seshadri; **Editing:** Rohit Pillandi; **Design:** Meeravali SK; **For more information:** Dr Sreenath Dixit d.sreenath@cgiar.org, Dr K H Anantha k.anantha@cgiar.org