

INDIA

Doubling Farmers' Income and managing watersheds

*In India, we have actively worked with and supported the government in its 'Doubling Farmers' Income' program; through our **CSR projects** we have shown how it is achievable. Other milestones include the development of a cost-effective **diagnostic tool for dry root rot** in chickpea and sharing with partners improved breeding lines of **biofortified** pearl millet and sorghum, **high-biomass** sorghum for biofuel needs and legumes that are **super-early, disease resistant, more nutritious, heat-tolerant and machine-harvestable**.*

Action plan brainstormed for [Doubling Farmers' Income](#)



In response to the Prime Minister of India's call for Doubling Farmers' Income by 2022, a workshop was held in New Delhi and the following was initiated:

- **Blueprint drawn up** for establishing pilot interventions in Maharashtra and Uttar Pradesh states;
- **Pilots to be later scaled in 18 districts:** These include 11 districts of Vidarbha region in Maharashtra state and seven districts of Bundelkhand region in Uttar Pradesh state;
- **New model presented:** An innovative model for farmers – Knowledge-based Integrated Sustainable Agriculture Network – Mission India for Transforming Agriculture (KISAN-MITra) – was presented at the workshop. The model aims at increasing productivity by efficiently using available resources, reducing cost of cultivation, minimizing post-harvest losses, processing for value addition, developing value chains and linking them to markets. Another goal is to increase employment options for women and youth through skill development employment by creating microenterprises and industries in rural areas.

ICRISAT in partnership with Vivekananda International Foundation (VIF), New Delhi and J Farms India (Tractors and Farm Equipment Limited) organized the workshop

CSR pilot projects record on average 100% increase in farmers' income

- Through Corporate Social Responsibility (CSR) projects, issues of increasing productivity and profitability for farmers was addressed while protecting the environment by adopting the integrated watershed management approach.
- **Ten pilot sites of learning** have been developed in the States of Karnataka, Telangana, Maharashtra, Andhra Pradesh and Odisha.

Impact:

- **100% increase in farmers' income** was recorded on average through adoption of improved watershed management approaches at the pilot sites. Cropping intensity increased by 70-100% over the baseline;
- **25,000 farming families recorded increased benefits** through interventions led by ICRISAT in participating States;
- **>1,000,000 m³ run-off water was conserved** by building rainwater harvesting structures with 500,000 m³ storage capacity. As a result, groundwater levels in the region increased;
- **>25,000 pilot farmers and NGO partners were trained** through 100 formal training programs along with field visits, demonstrations and other capacity building programs.

Wani and Raju 2018; Work Progress Reports submitted to CSR partners – RECL; Asian Paints Ltd; Tata Edu & Dev Trust; SABMiller India; Jindal SW Foundation; Powergrid Corp of India Ltd).

Impact of improved cultivars in Bhoochetana Mission Program, Karnataka

- **Improved management practices in pigeonpea cultivation:** Drip irrigation, transplanting, dibbling and nipping technologies were scaled-up in more than 10,000 ha.
Impact: 20-30% increased average yield benefit compared to farmers' practice.
- **Direct Seeded Rice:** This technique was scaled up in more than 30,000 ha.
Impact: 10-15% reduced cost of cultivation; minimum 50% saving of water.
(Wani and Raju, 2016; Work Progress Report submitted to GoK).
- **Benefits from improved cultivars with improved crop management practices of crops:** Rs 26,000 million (US\$ 450 million) in different districts for different crops over seven years.
(Wani et al 2017; Work Progress Report submitted to GoK 2014-15, 2015-16).

Impact of Direct Seeded Rice technology in Bhoosamrudhi projects

Bhoosamrudhi – a flagship initiative of the Government of Karnataka is supported by an ICRISAT-led consortium.

- *The initiative benefited farmers in four districts with 20,000 ha area under Direct Seeded Rice (DSR). This technology emphasis direct dry seeding of paddy using suitable machines (e.g., seed drill) instead of following traditional practice of puddling of field and transplanting of paddy seedling which has high cost of cultivation. This has also resulted in early establishment of paddy and saving of irrigation water by 50-60 per cent. ;*

- *Machine transplantation of paddy seedlings: Introduction of drum seeder in Udapi district has resulted in better crop establishment and reduction in cost of cultivation (Rs 38,000 (US\$ 567) per ha net income as compared to Rs 22,000 (US\$ 328) per ha with manual transplanting;*
- *Cultivation of rice fallows: Average additional income of Rs 7,000 (US\$ 104) to Rs 10,000 (US\$ 149) per ha for farmers who cultivated green gram and vegetable cowpea on rice fallows;*
- *Power weeders: Saved Rs 4,000 (US\$ 60) to Rs 5,000 (US\$ 75) per ha in cash crops like sugarcane and cotton compared to the physical method of weed control;*
- *Easy planters operated manually: Saved Rs 3,000 (US\$ 45) to Rs 4,000 (US\$ 60) per ha for transplanting vegetable seedlings in different pilot districts in Karnataka.*
- *Machine nipping of pigeonpea: Helped in inducing more secondary branches resulting in increased pigeonpea crop yields by ~ 8-10%.*

(Work Progress Report submitted to GoK; ICRISAT. 2017. Progress report (2016-17).

Dry root rot diagnosis becomes faster and 10 times cheaper



Dr Mamta Sharma checking chickpea DNA using LAMP. Photo: ICRISAT

Developed a visual, rapid and cost-effective LAMP (loop-mediated isothermal amplification) diagnostic tool for *Rhizoctonia bataticola* / *Macrophomina phaseolina* (dry root rot pathogen) in chickpea. It is –

- **10 times cheaper** than existing Polymerase chain reaction (PCR) methods and can quickly identify this pathogen infecting chickpea;
- **>500 other crops** including nutritionally and commercially significant crops such as soybean, maize, sunflower, groundnut, pigeonpea, jute, and sorghum benefit from the LAMP diagnostic kit which can be used for monitoring the disease and developing timely management strategies.

Cost-effective ways to reduce pre-harvest aflatoxin contamination

- A set of **Good Agricultural Practices (GAPs)** have proved to be cost-effective in groundnut:
 - Farmyard manure (5 t/ha), gypsum (500 kg/ha);
 - Protective irrigation at 90 days after sowing;
 - Drying of pods on tarpaulins after harvest in farmers' fields.

- **89 farms in 11 villages** in Anantapur district of Andhra Pradesh adopted GAPs and were compared with that of farmers' practices (FP) fields where these practices were not followed.

Impact:

- **Kernel infections and aflatoxins were significantly lower**, with 13–58% and 62–94% reduction, respectively, in GAPs plots compared to FP plots;
- **Average US\$58 per ha net gain** was realized through adoption of GAPs by farmers besides quality improvement of groundnuts.

This set of affordable GAPs are ready to be scaled up.

Improved breeding lines shared with partners

Grain legumes

Chickpea: **Machine harvestable Fusarium wilt resistant lines** – ICCV 08108 released as Phule Vikram in Maharashtra and ICCV 08102 released as RVG 204 in Madhya Pradesh;

Groundnut: **High oil variety** ICGV 03043 released as GJG 32 in the states of Karnataka, Andhra Pradesh, Telangana, Tamil Nadu and Maharashtra. **Drought tolerant and foliar fungal disease resistant** variety ICGV 07222 released as GJG 33 in Andhra Pradesh, Telangana and Tamil Nadu;

Pigeonpea: **Super-early with resistance to Fusarium wilt**. New CMS lines, maintainers and restorers were identified for the North -Western Plains, Central and Southern Zones of India and supplied to partners.

Cereals

Pearl millet

- A total of **360 hybrid parental lines** (both seed and restorer parents) in 15 nurseries were evaluated at 10-15 locations in India. The hybrids released using ICRISAT-bred parental lines include RHB 223;
- **Biofortified lines** with enhanced grain Zn and Fe concentration were identified. For the first time, two biofortified hybrids (ICMH 1202 as AHB 1200 and ICMH 1203 as HHB 299) were notified by the Central Variety Release Committee for all-India cultivation.

Sorghum

- **Biofortified lines** with enhanced grain Zn and Fe concentration were identified;
- **Fast-growing high-biomass lines** (25 t/ha dry biomass producing) for ligno-cellulosic biofuels production (7,200 liters of ethanol per ha) were developed.

Seed production of improved varieties/hybrids

In partnership with NARS partners, seed of improved varieties/hybrids was produced to enhance their adoption.

- **Chickpea:** 37 tons Breeder Seed, 38 tons Foundation Seed, 136 tons Certified Seed and 432 tons Truthfully Labeled seed was produced by the project partners.
- **Groundnut:** About 40 tons of Breeder Seed of two varieties ICGV 00351 and ICGV 91114 was supplied to seed corporations in Odisha for subsequent seed increase to produce about 4,000 tons of Certified Seed that can cover 20,000 ha area.
- **Pigeonpea:** More than 2,000 tons of hybrid seed was produced by public and private partners which can cover an area of more than 500,000 ha.

- **Pearl millet:** About 300 tons of biofortified cultivar seeds was distributed to farmers in India.

New initiatives and facilities at ICRISAT headquarters

Farm and Engineering Services has undertaken

- Seed production for ICRISAT materials on 40 ha;
- Completed construction of groundnut hybridization blocks for faster generation advancement by the breeders;
- Genebank gets three new medium-term cold rooms;
- Fabricated single-head threshers, plot threshers, peanut pod strippers for research use.