Innovation Factsheet - IRRI

Improved crop management and strengthened seed supply system for drought-prone rain-fed lowlands in South Asia

IFAD
Investing in rural people

CATEGORY 1

B | Innovation to improve rice crop management and seed system for drought- and flood-prone rain-fed systems – IRRI

PROJECT TITLE

Improved crop management and strengthened seed supply system for drought-prone rain-fed lowlands in South Asia

COUNTRIES

Bangladesh, India, Nepal (2016-2020)

IMPLEMENTING INSTITUTION

IRRI

Overview

Strengthening seed systems of climate-resistant varieties that respond to the needs of smallholder producers in their specific contexts is fundamental for building resilient cropping systems. The goal of this project was enhanced and stable rice productivity in the drought-prone rain-fed lowlands of South Asia, leading to improved HH food security and reduced poverty. Its objective was to alleviate poverty levels among farmers in rain-fed drought- and flood-prone areas by enhancing and stabilizing rice productivity through the combination of drought-tolerant rice varieties, adoption of improved management technologies, efficient seed supply system and accelerated scaling out.

The Challenge

- Drought and floods are major yield-limiting factors for rain-fed rice production in Asia. To harness the best potential of stress-tolerant varieties (STRVs) and drought-tolerant varieties (DTV), there is a need to improve their seed systems and disseminate appropriate management practices.

Innovations

- Mobile **Rice Doctor** and **SeedCast apps to improve crop management and better link supply and demand for seeds of improved and resilient rice varieties.**
- Promotion of new STRVs and DTVs combined with improved crop management practices (e.g. bio-pesticide and biofertilizer).
- GIS mapping and satellite imaging to target the scaling of STRVs and DTVs.

Examples of key results

- Higher yields.
- Integration of new approaches to upscale technical innovations increased uptake.

Lessons learned

- Dissemination of seeds of resilient varieties with best-bet management practices is fundamental.
- There is increased demand for DTV and STRV from NARES and producers due to increasing incidences of floods and droughts.
- Informing governments with evidence and engaging them to create an enabling environment is crucial.

The innovations

The integrated innovations promoted by the project included the following.

Technical innovations and crop management solutions: Improved crop and natural resource management technologies and diversification: new STRVs and DTVs along with improved nutrient-management practices. To further enhance the tolerance of rice DTVs under adverse conditions, microbes such as *Trichoderma* spp. and fluorescent pseudomonads as bio-pesticide and biofertilizer, enhancing root growth and thereby helping the plant to alleviate water stress under drought conditions.

Research approaches and results for guiding promotion of STRVs and DTV to contribute to addressing adaptation to climate change and resilience: Use of GIS and satellite imagery to successfully identify drought- and flood-prone rice areas in South Asia to target the distribution of locally suited rice varieties.

CATEGORY 1

Digitalized tools and platforms: (i) To strengthen the seed chain for many new rice varieties, including the STRVs, the SeedCast mobile application and web portal allows dealers to indicate to seed providers the demand for different varieties of rice seeds (**figure 2**). Farmers will have access to information on which seeds are available from which dealers, so they can access these for purchase and cultivation according to their needs and environmental conditions. Farmers can also use the application features to take decisions on varietal selection based on their land type and preferences. The information on seed demand is made available to seed corporations, state and district agriculture department authorities. It will help them to produce the preferred seeds in the required quantities. This can reduce the gaps between supply and demand of rice seed varieties and will also encourage the replacement of older, lower-yielding varieties of rice with new, higher-yielding varieties. (ii) The Rice Doctor mobile application for mid-season diagnosis and management of insect pests, diseases, abiotic stresses and agronomic problems helps to provide information on these problems as well as recommendations to address them.

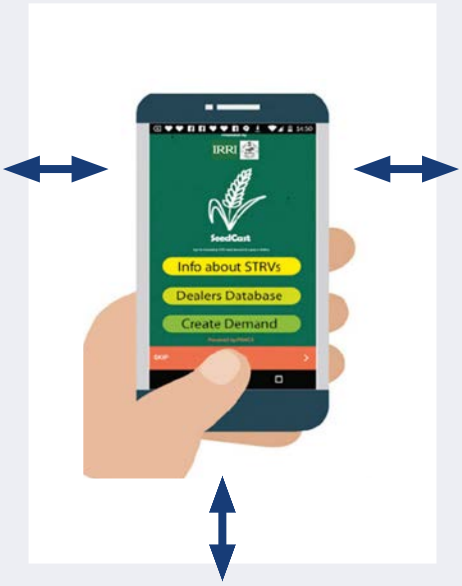
Figure 2: The IRRI SeedCast App to bridge the gap between seed demand and supply and strengthen seed systems

THE CHALLENGE

Seed varietal replacement is a key challenge in seed systems; new varieties are not able to penetrate new markets and target audiences. SeedCast is a digital tool to bridge the gap between seed demand and supply to strengthen the formal seed market and associated information system. The features of this app are designed to be expandable and replicable to other regions and crops.

GOVERNMENT, PARTNERS (NARES) AND IRRI

Promote app use, facilitate shift from conventional seed demand to demand-driven approach; foster seed production and supply and disseminate information ‘just before the season’ with realistic demand capturing the changed preferences of producers



‘SEED’ AGRO-DEALERS

Receive, estimate and collate demands from farmers for seed of rice (stress tolerant, drought tolerant, other improved varieties) to submit to state authorities

FARMERS

Access information on newly released climate-resilient, high-yielding varieties; select varieties according to their own need and agro-ecosystem. Ask dealers about the supply and stock availability of preferred varieties

Source: The figure was developed by the Authors; adapted from https://dev-static.irri.org/public/images/Holly%20folder/seedcast_v2.pdf

Benefits to rural communities

Use of STRVs along with location-specific best-bet crop and nutrient management practices were tested, developed and validated to increase rice productivity by 1 to 2 tonnes/ha in rain-fed uplands. For example, DTVs have out-yielded local cultivars and hybrids under drought stress. Cost-effective management options have also been employed for new STRVs in stress-prone environments and have shown high potential for enhancing yields. For example, 21- to 25-day-old seedlings were transplanted with two to three seedlings at closer spacing, while 30-40 kg of seeds/ha were sufficient for direct-seeded rice. Several short-duration, drought-tolerant rice varieties have produced yields **up to 45 per cent higher than popular varieties** in farmers' fields. Different **strategies were used to create awareness and to ensure local availability of quality seeds, including seed multiplication and demonstration, head-to-head trials, seed minikit distribution and a crop cafeteria.** About 84,400 farming HHs have directly benefited from drought-tolerant rice varieties.

GIS mapping was used to successfully identify drought- and flood-prone rice areas in South Asia to target the distribution of locally suited rice varieties. For example, using GIS and satellite images, drought- and flood-prone areas have been characterized in Nepal. In Terai, 917 wards in 8 districts were identified as suitable for dissemination of DTVs (ukhadhan 1 to 5).

To strengthen the local seed supply system, farmer groups and NGOs operating in remote areas are encouraged to produce STRVs. To generate significant direct economic gain to the poor farmers, along with climate resilience, the focus has been **to develop 'seed enterprise models'.** In **Bangladesh**, for example, a seed producers' group in Cox's Bazar Sadar has taken up seed production of climate-resilient rice, linked breeder-seed sources to producers' groups, and provided training to the producers in quality and seed marketing aspects.

Various **capacity-building** measures have been conducted to **strengthen formal and informal seed supply systems for STRVs** and to **promote seed entrepreneurship among stakeholders.** These have included training of trainers, training sessions on quality seed production and storage, and training in quality seed production in Rae Bareli (**India**).

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In addition, research carried out also defined site-specific nutrient management technologies for drought-prone rice-based cropping systems that are ready for scale-up. For example, a dose of 80-100 kg of nitrogen, 60-80 kg of phosphorous and 40-60 kg of potassium per hectare are optimum for these nutrient-responsive varieties. Application of 25 per cent nitrogen from ammonium sulphate, use of neem-coated urea, urea super-granules, application of vesicular-arbuscular mycorrhiza and phosphorous solubilizing bacteria showed marked improvement in the nutrient use efficiencies.

Lessons learned

In collaboration with NARES partners, the **best-bet management practices for the STRVs have been validated and disseminated along with seed of the improved varieties for adoption by farmers.**

Activities were designed to **develop management approaches at the farm level that optimized the growing of DTVs within the complete production system, considering all factors affecting productivity and quality.** Through the project interventions, management practices for DTVs, improved nursery and crop establishment options, direct seeding of rice, integrated weed management for drought-prone areas, system intensification and diversification opportunities with DTVs, were tested, validated and disseminated to the smallholder farmers. Low, inadequate and untimely fertilizer use is a major production constraint that has also been addressed to explore the full yield potential of high-yielding DTVs.

Scaling up and sustainability

According to IRRI, with increasing incidences of floods and droughts in South Asia due to climate change, there was a constant demand from NARES to scale the technologies. The project activities were aligned with different ongoing projects – ICAR-W3, Odisha Government project and APART. Development of site-specific best-bet management practices for newer STRVs in different abiotic stress-prone areas is ongoing. Scaling up these technologies can bring a huge impact through improved resilience and adaptation to climate change.

RESOURCES

IRRI. 2019. *Rice Doctor – An innovative technological approach to enhance rice production*. https://www.irri.org/news-and-events/news/rice-doctor-innovative-technological-approach-enhance-rice-production

Saksena, D., Variar, M. and Nayak, S. 2019. Rice varietal cafeterias: An effective extension tool for promoting climate-resilient rice. *Rice Today*. http://ricetoday.irri.org/rice-varietal-cafeterias-an-effective-extension-tool-for-promoting-climate-resilient-rice/

IRRI. *SeedCast*. https://www.irri.org/seedcast

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