India and ICRISAT

Enhancing agriculture, alleviating poverty

ICRISAT’s Work on Rainfed Agriculture

ICRISAT’s mission to find ways to reduce poverty, hunger, malnutrition and environmental degradation in the dryland tropics of Asia and Africa has given rise to four strategic thrusts that are anchored on the unifying concept of Inclusive Market-Oriented Development (IMOD), which mainstreams the dryland poor, especially women, so that they can participate and benefit from the development process.

The four strategic thrusts (or research programs) focus on: Resilient dryland systems; Markets, institutions, policies; Grain legumes; and Dryland cereals.

These research-for-development thrusts will generate products and innovations that will provide the poor with the goods and services they need to participate in IMOD. These programs demand that certain essential research and policy actions are put in place. In the case of pulse crops, the policy bias working against it must be replaced with a better policy.

One of the major established activities that come under the Markets, Institutions, Policies research is the Village Dynamics Studies in South Asia (VDSA). Analyses of VDSA data show that there have been changes in cropping patterns, for example, farmers are responsive to markets, policies, and options in their desire to maximize profits.

It becomes clear that dryland farmers need broader technology options that increase the productivity and profitability of coarse grains, cereals and pulses. This higher productivity and profitability can be actualized through:

- Biotechnology and new science tools for the development of drought tolerant and resistant cultivars;
- Increased productivity of integrated crop-livestock systems;
- Better management of soil, water and other natural resources; and
- Massive upscaling and commercialization of the Bhoochetana experience.

ICRISAT in India

A strong national research capacity and skilled scientific community made India the ideal location for ICRISAT’s headquarters. The Indian Council of Agricultural Research (ICAR) was also keen to have an international agricultural research center in the country. ICRISAT is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. ICRISAT is headquartered in Hyderabad, India, with two regional hubs and six country offices in sub-Saharan Africa. It belongs to the Consortium of Centers supported by the CGIAR. ICRISAT conducts research on five highly nutritious, drought-tolerant crops – chickpea (chana), pigeonpea (arhar), pearl millet (bajra), sorghum (jowar) and groundnut (mungphaili). It also develops sustainable farming practices for the semi-arid tropical (SAT) systems through efficient management of natural resources. ICRISAT also supports policies and institutional innovations for improving livelihoods of the smallholders; and in achieving food, nutrition and health security while protecting the environment in the dryland areas.

ICRISAT's Work on Rainfed Agriculture

ICRISAT’s work on rainfed agriculture focuses on developing strategies to enhance productivity and profitability of rainfed crops, including coarse grains, cereals, and pulses. This involves integrating new science tools with traditional agricultural practices to improve yields, adapt to climate variability, and increase farmer incomes. The institute has developed drought-tolerant crop varieties and improved farming systems that can withstand water stress and promote sustainable agriculture.

ICRISAT in India

ICRISAT has a strong presence in India, working closely with the Indian Council of Agricultural Research (ICAR) and other governmental and non-governmental organizations. In India, ICRISAT focuses on research programs such as Resilient Dryland Systems, Markets, Institutions, Policies, Grain Legumes, and Dryland Cereals. The institute aims to enhance productivity and profitability of crops like pearl millet, sorghum, and chickpea, which are critical for the food security of millions of farmers in India.
Rajasthan farmers grow pigeonpea and cook it into high-protein dal

About 6.0 million ha area in India is under pearl millet

Drought-tolerant groundnut variety, ICGV 91114 is

ICRISAT and Indian national program scientists

Projects Supported by India

ICRISAT is currently implementing over 67 projects generously supported by the GoI, state governments, public-private foundations, and institutions, which are being carried out in collaboration with the Indian national agricultural research and extension system (NARES). The outputs and outcomes of these projects have vastly improved crop productivity and food security, thereby helping reduce poverty and malnutrition in the drylands of India.

Vigorous collaboration between the Indian NARES and ICRISAT is focused on four major areas: (1) Genetic resources conservation, evaluation and utilization; (2) Enhancing crop productivity and sustainability under both favorable and dryland stress environments; (3) Improving systems productivity and livelihood for fragile and dry environments including socio-economic and policy options; and (4) Strengthening research for development farmer linkages.

The “Bhoochetana” (land rejuvenation) is a holistic program and farmer-participatory model that emerged from ICRISAT’s applied research alongside scaling-up of long-term strategic on-station research on natural resource management in collaboration with local partners.

In this innovative partnership program between ICRISAT and the Government of Karnataka, using soil analysis as an entry point, widespread deficiencies of nitrogen and micronutrients in farmers’ fields across Karnataka were recorded. By adopting a holistic approach, sub-district level soil test-based nutrient recommendations were developed, demonstrated, and scaled-out to cover 5.5 million ha in 30 districts of Karnataka. Nearly 4.75 million farming families are harnessing the benefits of the program through increased agricultural productivity. The estimated net economic gains from Bhoochetana are about US$ 240 million in four years.

Genome sequence and Molecular Breeding for Pigeonpea Improvement: Just after decoding the pigeonpea genome in November 2011, round table discussions were initiated between the Department of Agriculture & Cooperation (DAC), United States Agency for International Development (USAID) – India, ICRISAT and several leading pigeonpea research institutes across India.

Key issues related to pigeonpea improvement were identified and a framework for deploying generated genome information for pigeonpea improvement was designed. A pigeonpea research consortium was established in 2012 by combining breeding, genomics, and pathology and efforts were planned in three phases.

The project aims to advance pigeonpea as an important component of adaptation to the impacts of changing climate and climate variability, generating useful information to develop new cultivars for adapting to changing climate and improving the adaptive capacity of resource poor farmers in Asia and sub-Saharan Africa.

The Platform for Translational Research on Transgenic Crops (PTTC) is a unique initiative of ICRISAT with support from the Department of Biotechnology, GoI, to facilitate the translational research for potential transgenic technologies into usable products. PTTC features a state-of-the-art facility, comprising of sophisticated laboratory including a high-throughput transformation facility, molecular biology lab, instrumentation facility, walk-in cold rooms, and 10 ha of field facilities. We will add P2 level

with greenhouses, insect rearing facility and transgenic seed storage facility.

The Agri-Business Incubation (ABI) program at ICRISAT, through its handholding and mentoring services to the 22 Business Planning and Development (BPD) units set up under the National Agricultural Innovation Project (NAIP) of ICAR, has facilitated commercialization of 335 technologies and supported over 1200 entrepreneurs. BPDs have become self-sustainable in five years by generating revenue. ABI is a flagship program of ICRISAT that accomplished both national and international awards in its 10 years of operation.

Major Impacts of India - ICRISAT Partnership

From 1978-2014, 225 improved varieties of sorghum (43), pearl millet (85), chickpea (43), pigeonpea (23) and groundnut (31) have been released by Indian partners (using breeding material from ICRISAT), raising production and incomes of millions of smallholder farmers. Moreover, 41,796 national germplasm accessions have been repatriated from ICRISAT to the National Bureau of Plant Genetic Resources (NBPGR).

43 high-yielding chickpea varieties with early to medium maturity and high resistance to wilt have been developed and released in India through ICRISAT partnership with State Agricultural Universities in India. These varieties have shown high adaptability, particularly in central and southern India, and accounted for about 49% of the total indent of chickpea breeder seed in India during 2013-14. Efforts by ICRISAT and partners have led to a chickpea revolution in Andhra Pradesh, where production increased 8-fold in the past 15 years. ICRISAT-India partnership varieties (JG 11, JAKI 9218, KAK 2, and Vihar) were instrumental in the success. They cover over 90% of the chickpea area in Andhra Pradesh.

ICRISAT and Indian national program scientists developed pigeonpea hybrids (first in any grain legume in the world) based on cytoplasmic-nuclear male sterility (CMS) technology. The hybrids (ICPH 2671, ICPH 2740 and ICPH 3762) have recorded 30% to 40% higher yields compared to local and improved varieties under rained conditions. Commercially viable seed production technology was also standardized for large scale seed production. Currently ICRISAT, the National Seeds Corporation (NSC) and State Seed Corporations are on a mission to cover 100,000 ha during 2014 with pigeonpea hybrids and further expand hybrid pigeonpea area in coming years to the benefit of smallholder farmers.

Drought-tolerant groundnut variety, ICGV 91114 is replacing the 60-year-old TMV 2, which dominated groundnut production in Anantapur district of Andhra Pradesh. The breeder seed indent of ICGV 91114 (1636) amounts to 10% of the total breeder seed indent of the 51 groundnut varieties (1331) for the year 2014-15, indicating the popularity of the variety. An economic impact assessment has shown that ICGV 91114 has reduced yield variability by 30% in dryland areas.

Of the more than 30 sorghum hybrids cultivated during the rainy season on 3 million ha in India, 55% are based on ICRISAT-bred parental lines or derivatives. The first sweet sorghum hybrid GSH 2255 was released in 2005 by the National Research Center for Sorghum (NRCS), which used the ICRISAT-bred female parent ICSA38.

About 6.0 million ha area in India is under pearl millet hybrid cultivation, and 60% of about 100 pearl millet hybrids developed since 2000 by the NARS and seed companies in India are based on ICRISAT-bred material. ICRISAT in collaboration with NARS developed downy mildew resistant version (in 2011) of extra-early pearl millet hybrid HHB67, which was grown on about 875,000 ha in the most drought prone environment of north-western India. ICRISAT also bred the first biofortified cultivar of pearl millet ‘Dhanshakti’ with high grain Fe content of 72ppm. It has been notified as a biofortified pearl millet hybrid ICMH 1201 is being marketed in north Indian states starting 2014.