

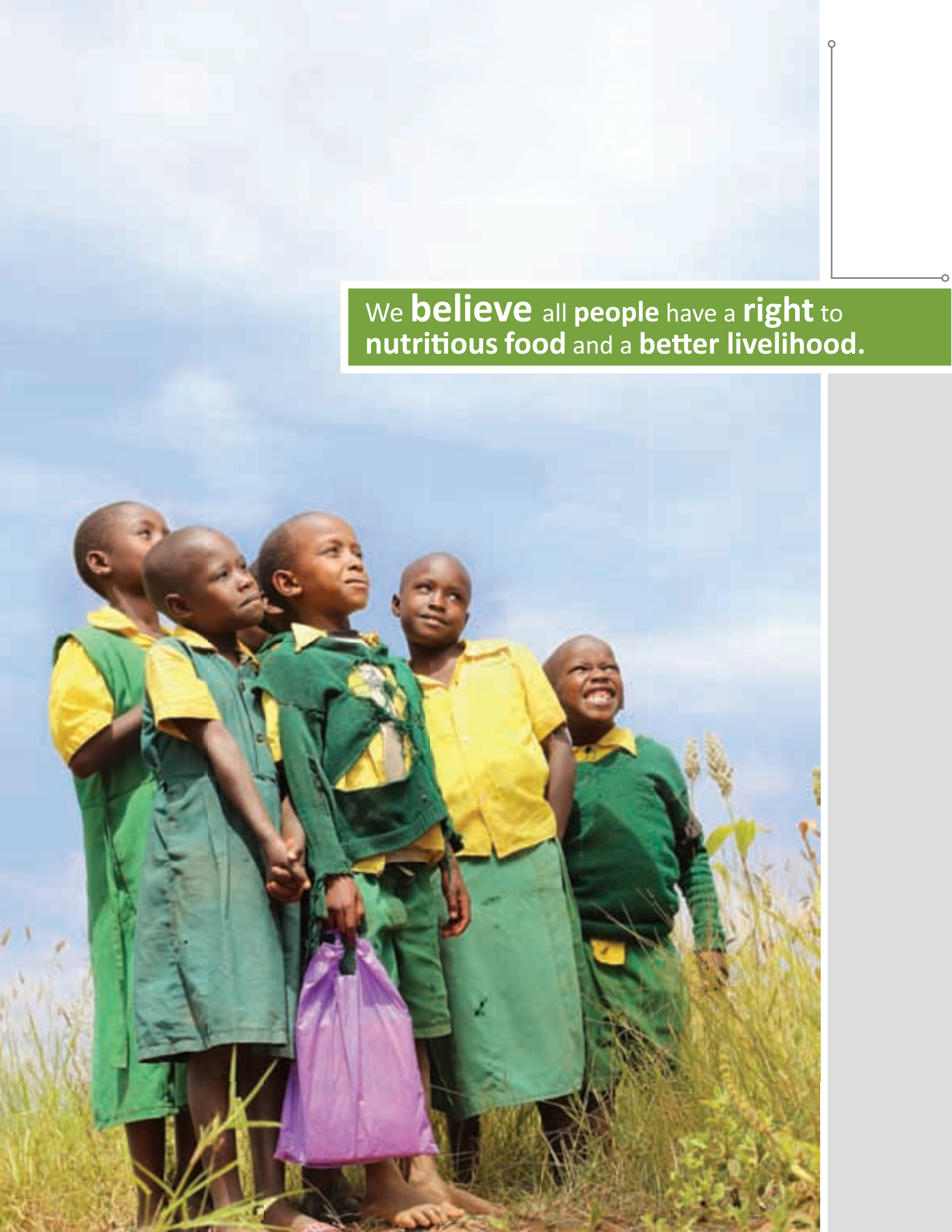
ICRISAT
Annual Report
2014

She makes a difference

Celebrating ICRISAT's Year of Gender



We **believe** all people have a **right** to **nutritious food** and a **better livelihood**.



She makes a difference

ICRISAT Annual Report 2014
Celebrating ICRISAT's Year of Gender



**International Crops Research Institute
for the Semi-Arid Tropics**

All dollars are in US\$.

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Message from the Director General



David J Bergvinson

New challenges posed by climate change, water scarcity and land degradation have changed the very vocabulary of agriculture research. It's no longer 'crop per drop' but 'nutrition per drop' and Prof MS Swaminathan, Father of India's Green Revolution, emphasizes on an 'Evergreen Revolution' that "enhances productivity in perpetuity without causing any ecological harm".

The challenge for us at ICRISAT is greater as we strive to make agriculture a profitable undertaking for smallholder farmers in the semi-arid tropics. We need to modernize the way we do agriculture and work with a sense of urgency, translating science for faster adoption and higher impact.

Over the year, we have made good progress with our focus on gender-inclusive, climate-smart agriculture; soil health and watershed management programs; unlocking the potential of ICT for development through mobile devices; promoting nutri-cereals through the Smart Foods campaign; and linking with entrepreneurs in Asia and Africa through the agribusiness innovation platform. Our work shows that the key to unlocking the potential of agriculture is demand-driven innovation that recognizes the important role of women and youth.

Year 2014 was ICRISAT's Year of Gender. This report illustrates how gender was integrated across the agricultural R4D value chain. This holistic approach actively seeks the participation of women, starting with analysis of problems and opportunities all the way through to agribusiness and market development. This empowers women farmers to

become profitable and manage risks arising out of climate change.

We have initiated work on mapping out country strategies and defining organizational values that build the culture required of a knowledge and innovation institute. Facilitating work across programs and disciplines and integrating research work in Africa and Asia is the first step.

Expanding the information ecosystem to unlock the potential of technology can intensify farming in a sustainable way. There is tremendous opportunity in digital agriculture. For starters, mobiles can be used to communicate targeted information to farmers to make profitable business decisions, connect to markets and access financial resources. The real potential of digital agriculture lies in cloud computing; remote sensing; geographic information systems and genomics.

Science is not an end in itself. It is a means to mitigate poverty, eradicate malnutrition and provide environmentally sustainable solutions to the most pressing challenges faced by the smallholder farmer. ICRISAT can achieve this by forging strong partnerships with the public, private and civil society sectors and realize its vision of a prosperous, food-secure and resilient dryland tropics.

We have a shared vision. We can aim higher and achieve more if we work together.

Finally, I thank all our staff, donors and partners for believing in our vision and dedicating themselves to the cause of the smallholder farmer; and to our Board for steering ICRISAT in the right direction.

Message from the Board Chair



Chandra Madramootoo

Over the past year, following my visits to our locations in Africa, I am fully convinced that there is a huge opportunity gap that can be filled by ICRISAT and our partners by working in concert to empower smallholder farmers through science. Both India and Africa have a lot to learn from each other. Knowledge, technology and ideas should flow seamlessly across continents in the best traditions of a South-South partnership. Consequently, ICRISAT management is increasing its dialogue with partners in the Government of India, and governments in sub-Saharan Africa, under the aegis of the South-South Agreement, to rapidly facilitate the transfer of knowledge, seeds and technology across this vast geographic region of the semi-arid tropics.

As evidence of the Institute's commitment to sub-Saharan Africa, I am pleased to report that the Governing Board has decided to boost its research in the region, by investing \$5 million towards upgrading research infrastructure and building scientific skills in the African continent. These new investments in science and research will provide opportunities for collaborative research with other CGIAR institutes and national agencies for research and development, and extension along the whole value chain.

The year 2014 marked ICRISAT's 42nd year of existence and was celebrated as the ICRISAT Year of Gender. Our gender-responsive goal is to increase benefits for women and men in terms of income, nutrition, and food security through improvements in the production and marketing of ICRISAT mandate crops so that gender inequality is reduced.

Closing the gender gap in agriculture is not just a lofty idea. UN studies have shown that if women farmers had the same access to land, technology, financial services, education and markets as men, agricultural production could be increased and the number of hungry people reduced by 100-150 million¹.

Global statistics on women farmers in Asia and Africa show that they account for 50% or more of the agricultural labor force and yet less than 20% are landholders. We at ICRISAT have a moral imperative to contribute to the improvement of the lives of 800 million poorest of the poor in the dryland tropics of the world, with a special focus on women.

The Governing Board believes that ICRISAT is in a very strong position to tap into new technology and move from being project-driven to having a broader, value-chain framework embedded in its country strategies. The Institute's programs and initiatives should not be built independently, but must all fit into a market-oriented development approach, create value for the smallholder farmer and deliver innovation and services beneficial to those who need them the most.

Furthermore, ICRISAT is in the process of redefining its organizational culture, particularly its core beliefs, shared feelings, and values – and empowering all staff to embrace this initiative. The magnitude of the task calls for everyone to collectively think of how to contribute in making a difference to the lives of smallholder farmers.

The Governing Board records its appreciation for former Director General, Dr William Dar, who steered ICRISAT through many trials and tribulations and placed it on firmer ground. During his 15-year tenure, ICRISAT's grant income increased four-fold, and he oversaw several new initiatives in Inclusive Market-Oriented Development, Agri-Business Innovation Platform, Center of Excellence in Genomics and the Institute leading two new CGIAR Research Programs in Dryland Cereals and Grain Legumes.

Finally, the Board is delighted to welcome Dr David Bergvinson as the new Director General, effective 1 January 2015. With his dynamic leadership, the Board is optimistic that ICRISAT will work collaboratively with all stakeholders, to improve the quality of life of 800 million people and smallholder farmers living in the tropical drylands.

1. <http://www.unwomen.org/en/what-we-do/economic-empowerment/facts-and-figures>

Vision

A prosperous, food-secure and resilient dryland tropics

Mission

To reduce poverty, hunger, malnutrition and environmental degradation in the dryland tropics

Approach

Inclusive Market-Oriented Development (IMOD)

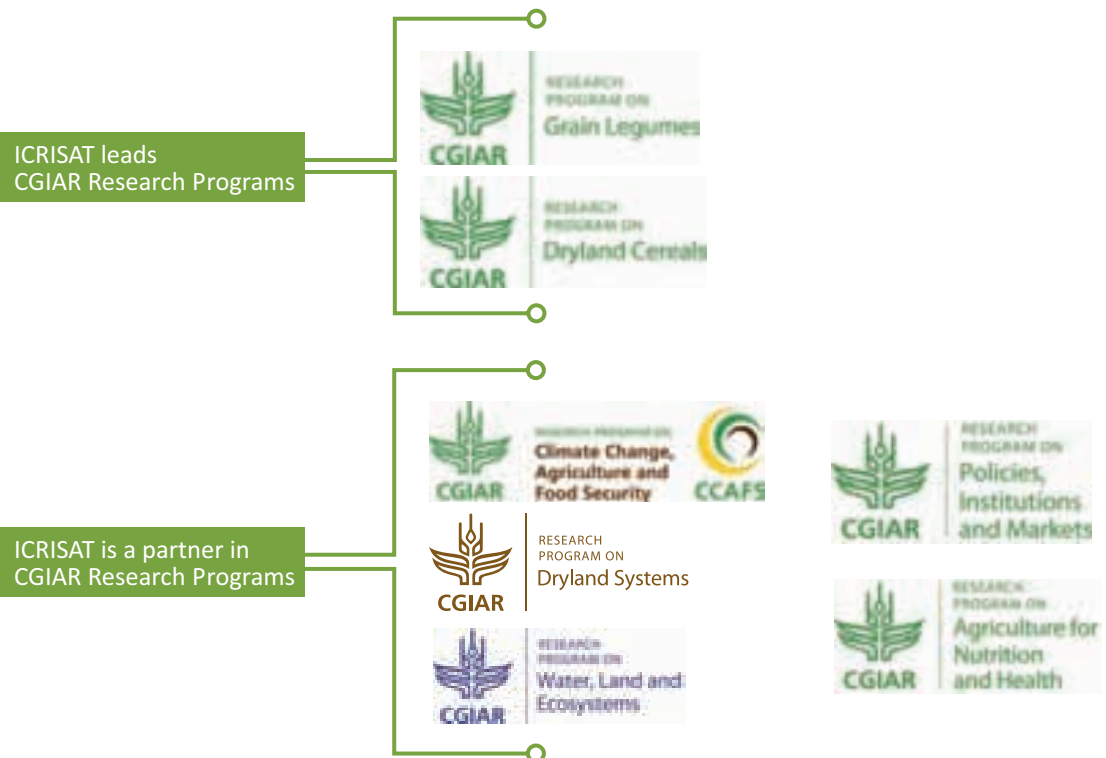
Research Programs

The work at ICRISAT is accomplished by four major research programs

- Resilient Dryland Systems;
 - Markets, Institutions and Policies;
 - Grain Legumes; and
 - Dryland Cereals, **along with the**
 - Agribusiness and Innovation Platform (AIP);
 - Knowledge Sharing and Innovation (KSI); and
 - Platform for Translational Research on Transgenic Crops (PTTC)
- under the overall framework of the Inclusive Market-Oriented Development (IMOD).**

Development Program

In 2014, the ICRISAT Development Center (IDC) was created.





Research highlights

Following are some highlights of our research work during 2014 towards fulfilling our commitments to both agriculture and the smallholder farmers of the semi-arid tropics.

Impact assessment studies

During the year, impact assessments were carried out on the Hybrid Parents Research Consortium for pearl millet, sorghum improvement in Mali, and fertilizer microdosing research and development in Niger.

Hybrid Parents Research Consortium-II, Pearl Millet Impact Study

Following up on an earlier study that assessed impacts of the consortium on seed companies, the Hybrid Parents Research Consortium (HPRC) for Pearl Millet Phase 2 study was implemented in 2014 to estimate farmer-level impacts. Based on the farmers' surveys, results show that pearl millet hybrids from the consortium had higher grain and fodder yields than non-HPRC hybrids and generated much higher social benefits. The HPRC hybrids generated social benefits of \$23.5 million in Gujarat, \$108 million in Rajasthan and \$38.4 million in Uttar Pradesh. The total social benefits on account of HPRC hybrids are estimated at \$169.9 million compared to \$103.3 million for non-HPRC hybrids.

An Economic Assessment of Sorghum Improvement in Mali

In 2014, an impact assessment study was led by independent consultants to assess the economic impacts of improved sorghum varieties released in Mali since 2000. Study results show that the estimated net present value (NPV) of investments in sorghum improvement research in Mali is \$16 million for the period 1997-2013 (the NPV period included the research lag years as there are costs associated with the pre-release period 1997-2000). The internal rate of return is estimated at 36% per year with a benefit-cost ratio of 6:1.

Impact of Fertilizer Microdosing Research and Development in Niger

This study implemented in 2014 assessed the impacts of microdosing research and technology transfer in Niger by looking at the factors that drive the adoption and continued use of microdosing. Survey data reveals that the use of fertilizer and, more specifically, microdosing have increased in Niger over time. However, the persistence of microdosing adoption is low.

The study further explored the potential yield differences between using microdosing and mixing fertilizer and seeds. Results show that the yield effects of fertilizer microdosing are significantly higher than those of mixing fertilizer and seed. Results also show that the marginal physical product of fertilizer use for farmers using microdosing is much higher at about 14.5 kg per kg of fertilizer applied, compared to mixing, which is about 4.5 kg per kg of fertilizer applied and not statistically significantly different from zero. Results show that households practicing microdosing are significantly more food secure than non-users.



Photo: S Patna, ICRISAT

Results show that pearl millet hybrids from the consortium had higher grain and fodder yields than non-HPRC hybrids and generated much higher social benefits.

Work on improved varieties

During 2014, several varieties of our mandate crops were released in India, Mali, Niger, Nigeria, Malawi, Tanzania from germplasm and breeding materials supplied by ICRISAT. These varietal releases were made possible through ICRISAT partnership with NARS, Farmer-Preferred Varietal Selection (FPVS)

trials, which facilitated shortlisting for fast track varietal release, and through sharing of materials across ICRISAT breeding programs in Africa. The varietal releases in Nigeria used materials originating from the ICRISAT groundnut breeding program anchored from Malawi.

Varieties released

Pearl millet

Dhanashakti (ICTP 8203 Fe 10-2), is the first high-iron biofortified cultivar of any crop variety officially released and adopted by farmers in India. Dhanashakti is an improved version of ICTP 8203 with superior iron density, grain and fodder yield.

Pigeonpea

ICPH 3762 is the first pigeonpea hybrid released for general cultivation in Odisha, India.

Two medium duration (ICEAP 00557 and ICEAP 00554) and two long duration (ICEAP 00053 and ICEAP 00932) varieties were pre-released in Tanzania, and four varieties have been promoted to National Performance Trials (NTP) in Uganda.

Finger millet

Five germplasm lines of finger millet (IE# 3575, 4415, 4625, 6045, 6337), two of foxtail millet (ISe 156 and ISe 1575) and one of proso millet (IPm 2769) supplied by the ICRISAT Genebank were released as varieties in India.

Two finger millet lines each in Kenya (IE 2872 and IE 4625) and Uganda (IE 2440 and IE 4115) were identified for testing in pre-release trials.

Sorghum

Six sorghum germplasm lines (IS 12611, IS 23525, IS 23541, IS 23555, IS 23519 and IS 23562) were released in Mali.

Groundnut

Farmers in Niger liked groundnut germplasm accessions ICG# 2167, 3621 and 9346 which performed exceedingly well, 3-4 times better than farmer-preferred varieties in the FPVS trials, and the participating farmers showed great enthusiasm for their large-scale cultivation during the 2015 rainy season.

Three groundnut varieties [GPBD 5, CTMG 6 and Co 7 (ICGV 00351)] were released in India; and two varieties (Samnut 25 and Samnut 26) were released in Nigeria.

Five groundnut varieties (ICGV 86124, ICGV 86015, ICGV-IS 92525, ICGV-IS 96802 and 55-21) have been promoted to pre-release status in Mali.

Seven genotypes – Virginia groundnut genotypes (ICGV-SM 01724, ICGV-SM 01731, ICGV-SM 08501, and ICGV-SM 08503) and Spanish genotypes (ICGV-SM 01514, ICGV-SM 99551 and ICGV-SM 99556) were released in Malawi.

Seed production

Hybrid pigeonpea reaches smallholder farmers in Asia

A total of 63,730 kg of hybrid seeds of ICPH 2671, ICPH 2740 and ICPH 3762 was produced by ICRISAT during the 2014 season and distributed to various stakeholders. About 503 tons of hybrid seed was also produced by India's National Seeds Corporation; State Seed Development Corporations and State Agricultural Universities of Andhra Pradesh, Telangana, Odisha and Madhya Pradesh; and private seed companies. The seed was distributed on subsidy to farmers by the governments of Maharashtra, Telangana, Andhra Pradesh and Odisha states of India.

Genomics

Genome sequencing of crops and microbes

The '3000 chickpea genome sequencing initiative' was launched together with partners such as the

International Center for Agricultural Research in the Dry Areas (ICARDA), Indian Institute of Pulses Research, University of Saskatchewan, University of Western Australia, and several state agricultural universities in India.

Several hundred chickpea lines have already been sequenced. In addition, the phenotyping data for several breeding related traits have also been developed. The analysis of sequencing and phenotyping data will provide the lines carrying superior alleles as well as marker-trait associations for accelerating molecular breeding activities for chickpea improvement.

A DArT marker platform for *Fusarium oxysporum* f sp. ciceris (Foc), a wilt pathogen of chickpea, was developed to understand the extent of diversity in Foc population/races present in India. This is the first DArT platform developed for any plant pathogen. This study will be useful to facilitate the efficient deployment of host resistance to fusarium wilt.



Photo: C Wangari, ICRISAT

Decoding the first peanut genomes for two diploid progenitors

Two progenitors of A-genome (*Arachis duranensis*, accession V14167) and B-genome (*A. ipaensis*, accession K30076) that are genome constituent of the tetraploid genome of cultivated peanut (*A. hypogaea*) were targeted for sequencing. The sequencing of genomes revealed 1.1 Gb genome size for A-genome progenitor (*A. duranensis*) and 1.38 Gb for B-genome progenitor (*A. ipaensis*). The genome sequence assemblies and additional information are available at <http://peanutbase.org/files/genomes/>. The availability of the genome sequence will provide researchers access to 97% of all peanut genes in their genomic context. ICRISAT played a key role in the US-led International Peanut Genome Initiative (IPGI). Several other advanced research institutions across the world also participated in this initiative.

ICRISAT Genebank

An external review panel rated the ICRISAT Genebank as outstanding and a model genebank in the entire CGIAR system. Over 2014, the genebank in India:

- Assembled 2,848 new accessions from the Crop Trust supported NARS collections.
- Characterized 2,886 accessions and updated databases.
- Regenerated over 8,500 cultivated and 142 wild relative's accessions and processed to mid- and long-term storage.
- Tested the seed viability of over 25,000 germplasm accessions.
- Safely duplicated seeds of 4,352 accessions of mandate crops and small millets at Svalbard Global Seed Vault.
- Distributed a total of 22,936 seed samples including those from mini core, composite collection, and reference sets to researchers in 29 countries for evaluation and utilization in crop improvement programs.

LeasyScan-phenotyping

A LeasyScan phenotyping platform, the first of its kind among CGIAR Centers, was established at ICRISAT. The phenotyping platform was designed to quickly measure leaf area so as to study the dynamics of leaf development and leaf conductance

traits that are the focus for plant drought adaptation. Technologies have been recently developed to increase the throughput and precision of phenotyping, relying mostly on imaging technology (infrared, RGB, NIR, hyperspectral, fluorescence). The focus is on the use of 3-D images to have a better evaluation of leaf canopy parameters, and of a “camera-to-plant” concept to increase throughput. The LeasyScan platform relies on this emerging concept, using scanners (PlantEye®) that project a laser line at a fixed wavelength on top of the canopy.

<http://phenospex.com/blog/vincent-vadez-from-icrisat-about-fieldscan/>

Dipstick device for detection of aflatoxin contamination

In a breakthrough discovery in Malawi, a Lateral Flow Device (LFD) has been developed to detect aflatoxin in field samples. This invention is driven by the high demand to test for aflatoxin contamination at various points along the groundnut value chain by grain aggregators, wholesalers, manufacturers and sales points of groundnut products. The dipstick device has been developed in the form of strips able to detect up to 20 ppb of aflatoxin in samples. If the sample is contaminated, the contaminant reacts with the antibody on the strip to produce a colored line. No visible line indicates absence of aflatoxin. The strip includes a negative control that develops color regardless of the



Photo: PS Rao, ICRISAT

presence or absence of the aflatoxin in the sample. The technology, though still under validation, will provide an affordable and reliable rapid testing kit for use by various actors in the groundnut value chain. It will also help in implementing proper management practices to mitigate aflatoxin contamination across sub-Saharan Africa.

Watershed initiatives

Restoring watersheds and addressing land degradation in Ethiopia

In Ethiopia, work is underway in five watersheds (range 700-7,500 ha) (Lemu district, Southern Regional State; Sinana district, Oromia region; Bosenia district, Amhara region; Mehoni district, Tigray region; and Worreilu district, Amhara region). A survey showed that natural resource degradation was so severe that crop yields had declined and farmers had largely abandoned the short rainy season because of unreliable onset of rainfall. In the Yewol watershed (Worreilu district), the impacts of earlier natural resource management interventions were assessed. There are visible landscape changes in productivity and resource flow due to integrated resource management. The communities, who had earlier abandoned crops during the short rains are now growing legumes and cereals. One of the major impacts is on increasing water access to downstream irrigation farms. The amount of irrigable land downstream increased from 200 ha to 947 ha in over

3 years, mainly due to soil and water management intervention on 7,500 ha of land upstream. Farmers are now growing high value crops during the dry season, and growing long maturing crops more often than before.

Village Dynamics Studies

For a deeper understanding of the links between agriculture and nutrition, the Tata-Cornell Agriculture and Nutrition Initiative (TCi) is partnering with ICRISAT to pilot test specific modules of the Minimum Nutrition Dataset for Agriculture (MNDA) in Village Dynamics in South Asia (VDSA) project villages.

TCi through its work on the MNDA aims to fill the agriculture-nutrition data void and establish a greater empirical understanding of the links between agriculture and nutrition. They aim to create minimum datasets with the most essential nutrition metrics to be inserted into longitudinal agriculture surveys.

As part of the VDSA project, ICRISAT has also been tracking nutrition status in villages of Andhra Pradesh and Maharashtra. The modules include:

- Essential health history questions (part of Module 1)
- Dietary diversity information/scores (part of Module 3)
- Market-level data on food availability and affordability (part of Module 3).

The first round of the pilot survey was conducted on the dietary diversity module in 2014 with two teams completing a total of 66 dietary diversity surveys in Dokur and Aurepalle villages of Andhra Pradesh.

Agribusiness and Innovation Platform (AIP)

Enabling agribusiness entrepreneurship development

In 2014, ICRISAT successfully joined the Indian Council of Agricultural Research (ICAR) in handholding the National Agricultural Innovation Project (NAIP). Under this project, ICRISAT supported Business Planning and Development (BPD) units of 17 ICAR research institutions and five state agricultural universities.



Photo: J Kane-Potaka, ICRISAT



Photo: ICRISAT

Over the project period of four and a half years, 22 BPD units were established to provide a conducive environment for agribusiness start-up entrepreneurs. This was achieved through technology transfer, scientific support, entrepreneurship development, establishment of their systems, processes, technology commercialization, entrepreneurship support services, and technology and business consultancy.

These BPD units formed the Network of Indian Agribusiness Incubators (NIABI) in 2014, a platform that provides one-stop solutions to the needs of agribusiness entrepreneurs in India. This is an innovative institutional initiative to promote agribusinesses through technology commercialization and entrepreneurship development. As a result of this initiative, over a period of less than five years, ICAR was able to incubate 1,218 ventures and graduate 91 ventures, commercialize 331 agro technologies; create around 200,000 jobs, and benefit 140,000 farmers, with an overall investment of \$10 million while generating a revenue of \$4 million for the system.

Millet and sorghum lines profiled for consumer-preferred traits and value-added products developed and commercialized through women entrepreneurs

Two product concepts ‘Healthy Snack’ and ‘Smart Brkfast’ based on sorghum and millets were developed and further refined to deliver acceptable consumer-preferred organoleptic traits by the NutriPlus Knowledge (NPK) program of AIP. Each

concept has been scaled up to commercial ventures involving women entrepreneurs.

The ‘Healthy Snack’ concept has seen the commercialization of flavored sorghum and finger millet extruded products by Indmillet foods™ (involving three women entrepreneurs) under the brand name Rigdam® (<http://rigdam.com/>). See our story ‘Game for Innovation’ on page 42.

The ‘Smart Brkfast’ concept has seen the commercialization of sorghum and pearl millet based breakfast cereal by Mathesis Engineers Pvt. Ltd. Food Product Division (involving a women entrepreneur) under the brand name Navya™.

Both enterprises are receiving business development as well as technical support from AIP for establishing their respective business enterprises.

Digital agriculture

One Agriculture-One Science: A global education consortium

ICRISAT and University of Florida, together with Michigan State University, and Iowa State University launched a ‘One Agriculture-One Science: Global Education Consortium’ in 2014. This will serve as a common platform and help to revitalize global agricultural education, thereby contributing to global food security. The One Agriculture–One Science community provides an enabling environment for aggregating, translating, and co-creating agricultural knowledge and educational resources for addressing global hunger and food security challenges.

GreenPHABLET powered by the GreenSIM

This is an ICT-mediated pull and push-based extension system (mobile and web apps, voice advisory services, participatory video extension methods) that brings the best of affordable technologies and knowledge solutions to the doorsteps of smallholder farmers. It is built on a public-private partnership model. The system was piloted in three experimental hubs to explore and understand various dimensions and dynamics of ICT mediated extension systems by government, non-government organizations and civil society organizations.



Awards

ICRISAT-led Krishi Gyan Sagar and Krishi Vani won the Flame Award 2013 from Rural Marketing Association of India during the year.

Dr Paul Van Mele and Marcella Vrolijk from Agro-Insight, Dr Eva Weltzien-Rattunde, ICRISAT-Mali, and Dr Tom van Mourik (formerly with ICRISAT)

won the Gold Award for effective communication for the high impact "Fighting *Striga*" videos in London.

For complete list of awards see web version.

Peter Carberry
Deputy Director General-Research

Smart Foods conceptualized

In 2014, ICRISAT conceptualized Smart Foods and started to lay the groundwork for a Smart Foods campaign.

Smart Foods are foods that are:



GOOD FOR YOU
highly nutritious and healthy;



GOOD FOR THE ENVIRONMENT
eg, have a small water footprint, require few pesticides or other inputs, are climate resilient and are ...



GOOD FOR SMALLHOLDER FARMERS
a traditional crop that is highly resilient and will be the last crop standing in harsh conditions, has multiple uses and greater potential for improvement.



Millets (including sorghum) and later grain legumes will be the focus of the Smart Foods campaign. Building consumer demand is core to the campaign. This will be achieved through creating a modern image of millets, building awareness, creating a buzz around millets, and engaging policy makers and R4D investors.

GOOD FOR YOU

NUTRIENT DENSE GRAINS

Millets are high in protein, vitamins and micronutrients



Finger millet
340mg/100g calcium
3 times more than milk

Pearl millet
iron 75mg/kg zinc 43mg/kg

Bioavailability
studies show that a meal with pearl millet can provide the daily allowance of iron and zinc for the average person.

MULTIPLE HEALTH BENEFITS

Their **low glycemic index** helps manage blood glucose levels and prevent diabetes.

Millets are high in antioxidants
Pearl millet has the highest folic acid content among cereals, which lowers heart disease and cancer risks and is recommended to pregnant women.
Millets are gluten free.

GOOD FOR THE PLANET

HARDY AND DROUGHT TOLERANT

Only need 350-400 mm annual rain

HEAT TOLERANT

Some pearl millets survive at temperatures of up to 64°C.



GROW FASTER

Some millets need 60-65 days to mature against 100-140 days for wheat



FOOD SOLUTION IN A CHANGING CLIMATE

With global warming, 40% of land where we grow maize in sub-Saharan Africa may not support that crop by 2030.

A CROP TO BRING DIVERSITY ON FARM FOR SUSTAINABLE AGRICULTURE

Easier to grow for poor farmers with diicult access to inputs.

Greater on-farm crop diversity reduces pests, climate risks, improving farmers' overall resilience.

Millets can grow without or with **little fertilizer and pesticide.**



GOOD FOR SMALLHOLDER FARMERS

CRUCIAL TO FIGHT POVERTY AND GROW FOOD SECURITY

For more see:

http://www.icrisat.org/smart-foods/Flyer_on_Smart_Food_Full.pdf

Creation of the ICRISAT Development Center



Photo: Vidyasagar, ICRISAT

In April 2014, the ICRISAT Board approved the creation of the ICRISAT Development Center (IDC). This was a bold move to **focus on the adoption of proven technologies**, to bring about **more impact**.

IDC takes ICRISAT's R4D results to more communities, scaling up and out. The development work encompasses:

- ▶ **Community level adoption** particularly as part of **companies' corporate social responsibility**
- ▶ And **large scale adoption** mainly with financial support from **governments and development institutions**

While the **core focus is development**, **scientific research is applied while undertaking the implementation** which is important to ensure sustainable solutions and large-scale impacts.

Also the **science of scaling up is analyzed** as part of the development process and **lessons learnt are captured**.

IDC's role is that of a **catalyst** to make things happen by building appropriate partnerships convergence, and **technical backstopping**.

IDC will help ensure ICRISAT's scientific research achieves major impact in reducing poverty, hunger, malnutrition and environmental degradation across Asia and Africa by adopting a holistic science-led approach.

IDC had immediate success by building on its experience with the Bhoochetana Project that reached 3 million farmers in the first three years. Using this model and reputation earned, by the end of 2014, IDC had 15 projects with \$ 21m committed.

<http://www.icrisat.org/icrisat-development-center.htm>

IDC investors currently include





Dr Paco Sereme (left) examining the diverse pearl millet hybrid parents along with Dr Stefania Grando.



Board Chair Dr Chandra Madramootoo (right) with Dr Rachel Chikwamba.



Board members being felicitated by Kothapally village community. (L to R) Dr Gry Synnevag, Dr Rachel K Chikwamba and Dr Deborah Delmer.



Photos: PS Rao, ICRISAT

Dr Nigel Kerby (left) and Dr Meryl Williams.



ICRISAT

Governing Board 2014

Nigel Poole, UK

Chair, ICRISAT Governing Board
(until Apr 2014)

Chandra A Madramootoo, Canada

Chair, ICRISAT Governing Board
(from May 2014)

William D Dar, Philippines

Director General
(until Dec 2014)

Deborah Delmer, USA

Member
(until Nov 2014)

Oluwande Muoyo, Nigeria

Member

Rajiv Sharma, IAS, India

Member
(from Jun 2014)

Gry Synnevag, Norway

Member

Nigel Wells Kerby, Britain

Member
(from May 2014)

S Ayyappan, India

Vice-Chair

Ashish Bahuguna, IAS, India

Member

Molapo Qhobela, South Africa

Member
(until Apr 2014)

Rachel K Chikwamba, Zimbabwe

Member
(from May 2014)

Paco Sereme, Burkina Faso

Member

PK Mohanty, India

Member
(until May 2014)

Meryl Williams, Australia

Member
(until Sep 2014)



Photo: PS Rao, ICRISAT

ICRISAT Governing Board (left to right): Meryl Williams, Rajiv Sharma, Nigel Wells Kerby, Rachel K Chikwamba, David J Bergvinson, William D Dar, Chandra A Madramootoo, Oluwande Muoyo, Ashish Bahuguna, Deborah Delmer, Paco Sereme and S Ayyappan at the 71st Governing Board meeting at ICRISAT headquarters.

ICRISAT Ambassadors of Goodwill

New ICRISAT Ambassadors of Goodwill during 2014 are shown here. The ICRISAT Ambassadors of Goodwill, launched in 2013, aimed at enlisting the support of outstanding personalities in championing the Institute's mission. The Ambassadors will help champion ICRISAT's work in science-based agricultural solutions for improving livelihoods and attaining food and nutrition security. They will motivate and inspire individuals and organizations to support the cause of smallholder farmers in Asia and sub-Saharan Africa.



Photo: PS Rao, ICRISAT

Professor MS Swaminathan

Renowned agricultural scientist and Father of India's Green Revolution (right).



Photos: A Diamo, ICRISAT

Dr Akinwumi Adesina

Minister of Agriculture and Rural Development, Federal Republic of Nigeria (right).



Photo: PS Rao, ICRISAT

Ms Saina Nehwal

Olympic medalist, ace badminton player and youth icon of India (left).



Photo: PS Rao, ICRISAT

Dr Nigel Poole

Former Board Chair, ICRISAT (left).



Photo: ICRISAT

Hon John Kerin AM

Chair of the Crawford Fund and former Australian national Minister for Primary Industries and Energy, and for Trade and Overseas Development (right).

Our people

Diversity

28
Nationalities

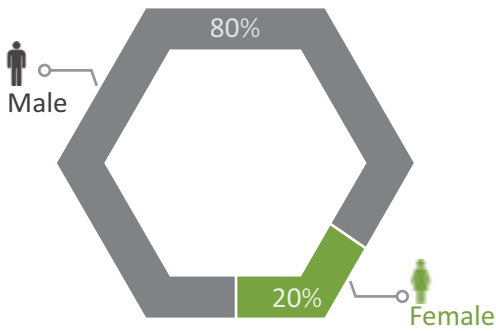
8
USA, Europe
and Australia

5
Asia and
Southeast Asia

7
West and
Central Africa

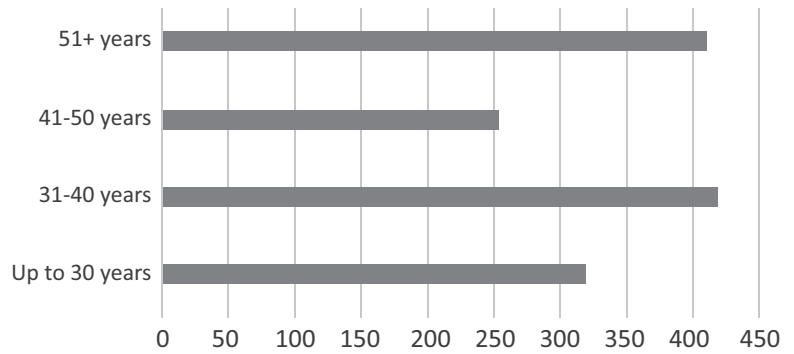
8
Eastern and
Southern Africa

Gender



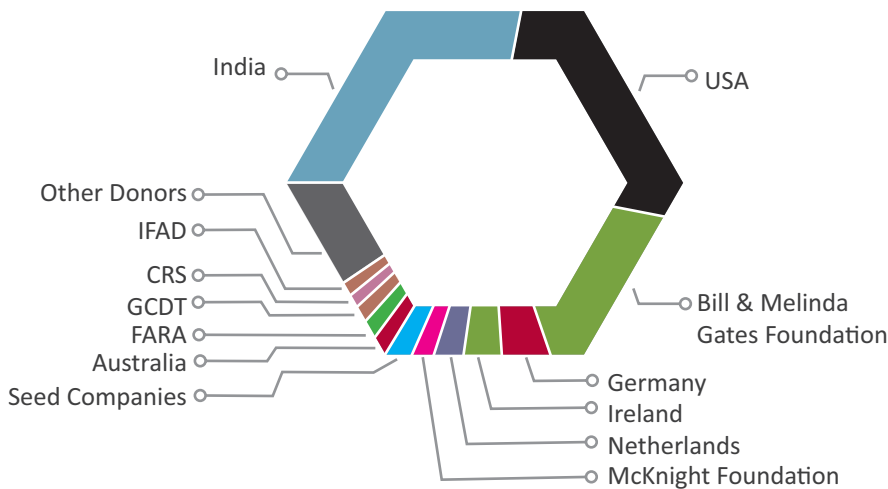
For list of sta refer web version.

Age



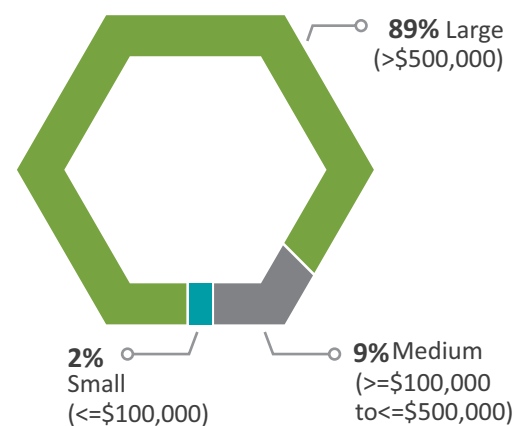
Projects

Projects funded



For list of new projects refer web version.

Projects by size of grant



Financial summary

Balance Sheet

		US\$ thousands	
		2014	2013
Assets	Cash and Cash equivalents	11,054	19,260
	Investments	54,818	51,239
	Accounts receivable	12,335	13,842
	Inventories	944	920
	Prepaid Expenses	475	435
	Property and Equipment - net	8,891	7,585
	Other assets	4,637	3,921
	Total Assets	93,154	97,202
Liabilities	Accounts payable	16,176	19,808
	Accruals and provisions	2,725	2,595
	Payments in advance from donors	27,820	27,660
	Long-term liabilities	7,642	11,352
	Total Liabilities	54,363	61,415
Net Assets	Unrestricted		
	Undesignated	19,446	16,431
	Designated	15,113	15,113
	Permanently Restricted	4,232	4,243
	Total Net Assets	38,791	35,787
Total Liabilities and Net Assets		93,154	97,202

Operating results and movements in Net Assets

		US\$ thousands	
		2014	2013
Operating results	Revenue	87,987	82,995
	Expenditure	85,849	80,718
	Change in net assets, operational	2,138	2,277
Net Assets - Unrestricted	Undesignated		
	Balance, beginning of the year	16,431	19,064
	Operating (deficit)/surplus for the year	2,138	2,277
	Gratuity/Pension reversal	877	90
	Transfer to Appropriated	-	(5,000)
	Balance, end of the year	19,446	16,431
	Designated		
	Balance, beginning of the year	15,113	10,113
	Transfer from unappropriated	-	5,000
	Balance, end of the year	15,113	15,113
Total Unrestricted Net Assets	34,559	31,544	
Restricted	4,232	4,243	
Total Net Assets	38,791	35,787	

Grant Income from Donors for 2014

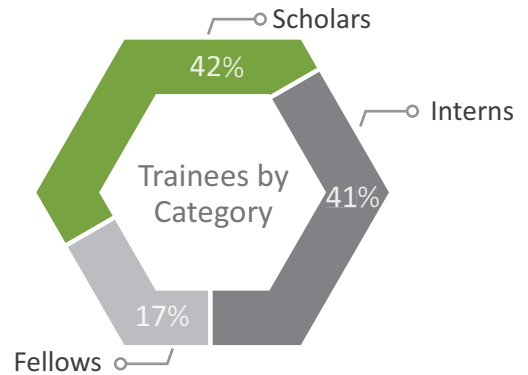
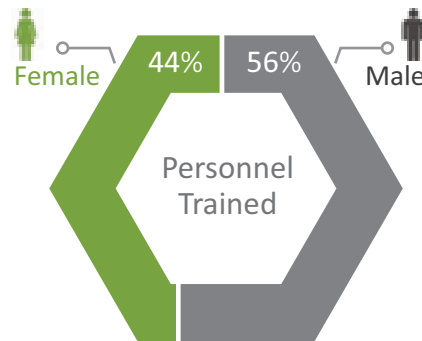
Donor	US\$ '000	Donor	US\$ '000
CGIAR Consortium	42,504	Other Donors	214
Consortium Research Centers	16,434	Austria	213
India	7,460	United Kingdom (UK)	167
United States of America (USA)	6,910	Navajbai Ratan Tata Trust (NRTT)	153
Bill & Melinda Gates Foundation	4,385	Sir Ratan Tata Trust (SRTT)	145
Germany	1,126	China	98
Ireland	982	France	86
Netherlands	711	Common Fund for Commodities (CFC)	79
McKnight Foundation	510	European Commission (EU)	69
Seed Companies	464	Coca-Cola India Foundation	64
Australia	414	Care Inc.	50
Forum for Agricultural Research in Africa (FARA)	385	Food and Agriculture Organization (FAO)	44
Global Crop Diversity Trust (GCDT)	365	Alliance for a Green Revolution in Africa (AGRA)	42
Catholic Relief Services (CRS)	360	Institut d'Economie Rurale (IER)	25
International Fund for Agricultural Development (IFAD)	331	Thailand	20
Japan	317	Action Contre la Faim (ACF)	12
Philippines	288	CORAF/WECARD	9
Office Cherifien des Phosphates Foundation (OCPF)	229	Turkey	5
Nigeria	228	Aga Khan Foundation (AKF)	2
		Grand Total	85,900

Knowledge sharing

Capacity building

8,716

Training courses and scientific visits conducted



For full list of training programs conducted see web version.

Research publications



215 Articles in journals listed by ISI/Thomson Reuters

76 Articles in other peer reviewed journals

14 Books co-edited

74 Book chapters

46 Monographs

128 Conference papers

4 Policy briefs

KSIconnect: A Virtual Knowledge Series from ICRISAT

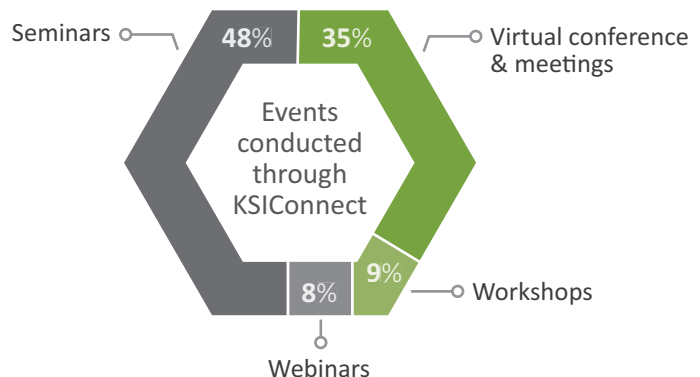
Through a series of science seminars broadcast virtually, KSIconnect enables knowledge sharing among ICRISAT scientists and eminent visitors about their ongoing work. KSIconnect compresses time and cost by facilitating virtual seminars, meetings, farmer-expert interactions providing direct access to technical experts and latest scientific innovations.

682 Total no of videos

33,739 Total no of views

114,677 Estimated minutes watched

158 Total subscribers





ICRISAT in the media

► Our presence in print and electronic media

2014 ► Major global/ national media stories

FINANCIAL TIMES, UK



William Dar advocates easier access to published research



Can global farm innovators help re-green the Sahel?



L'agriculture du futur fait son show à Abu Dhabi: quelles solutions pour reverdir le Sahel?



William Dar talks about agri-business and ICRISAT's work to reduce poverty.



Agricultural research gets gender transformation approach



First agri-business incubator in West Africa established



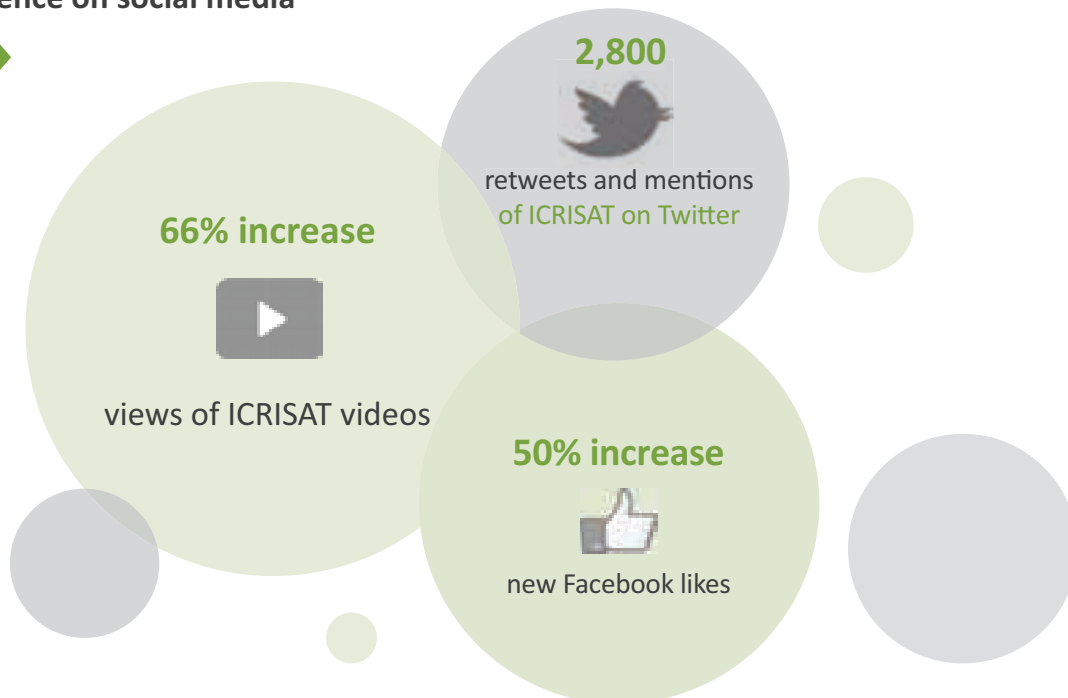
ICRISAT identifies climate resilient germplasm to support chickpea breeding



Phablets for farmers

► Our presence on social media

During 2014







“ Investing in rural women is investing in the community.

When women are economically empowered, they make sure their children are fed, get proper nutrition and stay in school, which in effect can reverse the migration trend from rural to urban areas among the youth.

– Dr Kanayo Nwanze
President, IFAD

ICRISAT's Year of Gender

Gender inequality is one of the reasons for the agriculture sector underperforming in the developing world. The FAO report on Women in Agriculture* states that if women had the same access to productive resources as men, they could increase yields on their farms by 20–30%.

Women farmers control less land than men, and also have limited access to inputs, seeds, credits, and extension services. To add to that women have primary responsibilities for household and child-rearing activities in most societies.

Recognizing that the contribution of women to agriculture is critical to achieve global food security, ICRISAT designated 2014 as the Year of Gender to focus on how the institute can integrate gender into all aspects of its research for development work.

Gender Forum launched at ICRISAT

ICRISAT Gender Forum was launched on 26 May. The Forum seeks to integrate gender in agricultural research leading to more effective development outcomes and impacts. At the launch, regional gender specialists were introduced. Dr R Padmaja spoke on how strategic gender research is expected to translate into larger development outcomes such as food security, nutrition and improved health, increased income and gender equity across the CGIAR Research Programs.

Regional gender specialists:



Dr R Padmaja

Research Program - Markets, Institutions and Policies based in South Asia



Dr Wenda Bauchspies

CGIAR Research Program on Dryland Cereals based in West and Central Africa



Dr Esther Mwihaki Njuguna

CGIAR Research Program on Grain Legumes based in Eastern and Southern Africa

The **Second Gender Forum meeting** was held at ICRISAT-Mali on 26 June. A resolution was taken to incorporate gender responsive practices in all of ICRISAT's work. Scientists debated on the issue. This led to the practical issue of "what goes in the gender column of our work plans" and the reflection that each research project will have its own requirements.

<http://www.icrisat.org/Gender-forum.htm>

The **Third Gender Forum meeting** was held at ICRISAT-Kenya on 30 July. Dr Maureen Miruka, Team Leader of the Pathways program at CARE USA was the guest speaker. She spoke of gender dialogues as avenues to identify 'gender exploitative' practices in rural communities.

<http://www.icrisat.org/Gender-Feminization.htm>



Stills from the film "A Day in the Life..." screened at the ICRISAT Gender Forum launch (www.youtube.com/watch?v=MEwwnEsbdkk). The film portrayed the societal challenges faced by Yamma from Aurepalle village in India, who managed to break out of intergenerational poverty. Her life has been documented as part of the Village Level Studies since 1975.

*<http://www.fao.org/docrep/013/i2050e/i2050e.pdf>

Recognizing outstanding women farmers in India



Photos: S Punna, ICRISAT

Over 1,500 women farmers from 12 states of India attended ICRISAT Women Farmers Day.

Status of rural women

- Women produce 50% of the world's food, but own only 1% of the land
- Rural women make up 25% of the global population
- The number of rural women living in poverty has doubled since the 1970s.

Source: <http://www.aas.cgiar.org/content/rural-women-face-facts>

The ICRISAT Women Farmers Day held on 12 September was a celebration of the achievements of India's outstanding women farmers whose ingenious and resourceful ways have placed them at the forefront of the fight against poverty, hunger, malnutrition and environmental degradation.

Thirty women were recognized as Golden awardees, and another 53 women as Silver awardees. Profiles of these women farmer leaders have been compiled into a book (www.icrisat.org/PDF/INDIAN-Women-Farmer.pdf). Interviews on: www.youtube.com/watch?v=hpuW5W9uZJk



Photo: Kaushik/ICRISAT

Gender web page

For latest news on gender research being undertaken, stories and videos from the field, a page was launched on the ICRISAT website: www.icrisat.org/icrisat-gender-approach.htm.

For scientific information on gender: <http://exploreit.icrisat.org/page/gender/660>





Integrating gender across the agricultural R4D value chain

Towards an inclusive environment



ICRISAT has developed this agricultural R4D value chain graphic to represent the holistic approach we take working from land and water management all the way through to agribusiness and market development. Here are examples of how we have integrated gender at each stage of the agricultural R4D value chain.



EQUAL SAY IS THE KEY
Watershed projects in India and Africa show the way



EQUIPPING NURTURERS
An Indian farmer shares her story



SMART FOODS: NUTRI-CEREALS FOR HER
The creation of biofortified pearl millet in India



SOWING SEEDS OF PROSPERITY
A success story from Malawi



CLIMATE-SMART WOMEN
Snapshots from Madhya Pradesh, India



HER OPINION MATTERS
A Southeast Asia project sets an example



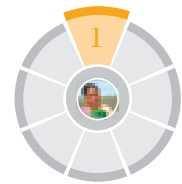
GAME FOR INNOVATION
Women in India and Africa try out new technologies



SEED PRODUCERS GET MARKET-SAVVY
Women in Niger bag the best deals



CREATING A MARKET FOR HER
Innovation Platforms in Zimbabwe make it possible



Equal say is the key

Watershed projects in India & Africa show the way



Photo: P Panjiar/ICRISAT

Rajasthan is one of the priority regions for watershed interventions in India.

Having 50% women on watershed committees in India has ensured that their concerns are addressed in decision making. It has also empowered them to have an equal say in community affairs.

INDIA

Interventions

Change in focus

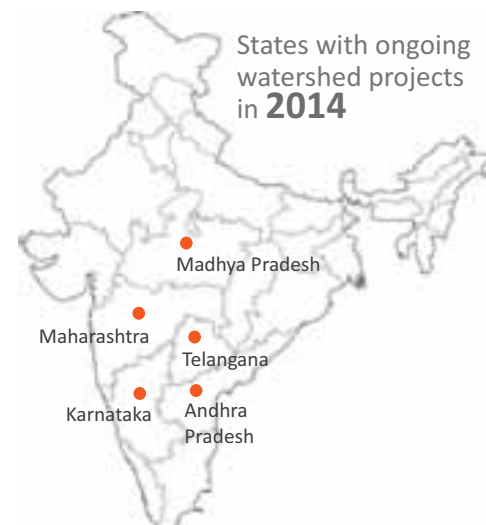
Adoption of a **holistic community-based approach**, created a voice and stake for the landless, poor and women taking it further than soil and moisture conservation and water harvesting interventions.

Knowledge is power

Trainings on new on-farm practices instilled confidence, created awareness and equipped women farmers.

Money matters

Self-Help Groups (SHGs) facilitated women to save and invest in businesses.



Impact

Women as agents of change

▶ She leads by example

LATA BAI – Member, Kalbherav Watershed Development Committee, Maharashtra



- She is the first farmer in the project to construct a farm pond in her field. She motivates other farmers to do the same.
- She played an active part in watershed interventions, especially selecting sites for check dams and taking part in the construction.
- She does not hesitate to raise issues of concern and asks for interventions at the right time.
- She is always ready to try new technologies.

▶ A social health activist and model farmer

SUJATHAMMA – Member Watershed Committee, Muduvatti, Karnataka

- Villagers respect her leadership in the agricultural community especially with regard to diversifying farm activities. She cultivates finger millet and uses part of the land for a mango plantation. She maintains livestock for additional income.
- She is an accredited social health worker and also a member of the village Self-Help Group.



All the three women leaders were recognized for their work on Women Farmers Day on 12 September 2014 at ICRISAT headquarters.

▶ Four wells were on her 'to do' list

GEETA BAI – Member, Model Watershed Committee, Siyalwada, Madhya Pradesh

- Joining the watershed committee gave this tribal woman of poor socio-economic status the courage to overcome male dominance and caste dynamics.
- In 2014, she contested elections to the local self-government. She was elected as a member and she raised the proposals of tribal families under Mahatma Gandhi National Rural Employment Guarantee Act for digging wells.



- As a member of the watershed committee, she raised four proposals for water storage structures in her village and took responsibility for their completion.

AFRICA

▶ Yewol Watershed, Ethiopia:

- About 25% of the watershed members are women;
- Plans are in place to increase the participation of women in new watersheds.

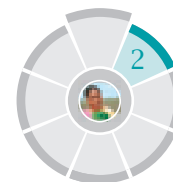


Photo: J Kane-Potaka, ICRISAT

Other watersheds in the pipeline in Ethiopia:

- ▶ Logo Haik Watershed
- ▶ Gudo Beret Watershed
- ▶ Lemu Watershed
- ▶ Mehoni Watershed





Equipping nurturers

An Indian farmer shares her story

Trained women farmers add to their income by adopting eco-friendly ways – enriching the soil by recycling farm waste through vermicomposting, raising Gliricidia nurseries for organic fertilizer and managing water resources.

Ms Sheela Sikandur adopted the integrated farming approach and diversified multiple cropping system to convert her barren field into a profitable business model. Today, her net income from the land is ₹120,000 (\$1,888) per year.



Ms Sheela Sikandur on her organic farm.

Restoring barren land

Managing water resources and improving soil

Ms Sheela from Raichur, Karnataka, India, owned a 1.3 ha barren plot of land. To rejuvenate the land and make it productive she adopted an integrated farming approach.

In 2010, to save water on her farm, she installed a drip irrigation system and constructed a farm pond

with a capacity of 600,000 liters. In 2012, she took part in the participatory soil sampling conducted in her area and played an active role in encouraging fellow farmers to participate in the initiative.

The soil test in her field revealed severe deficiencies in organic carbon and phosphorus and high potash. The soil was also severely deficient in secondary and micronutrients – sulfur, boron and zinc – resulting in low crop yields.

She consulted fellow lead farmers and constructed a vermicompost unit. She learned how to prepare compost and use it as fertilizer.

Learning from the Bhoochetana program, she started using balanced nutrient management practices, focusing more on the use of organic manure and replenishing deficient secondary and micronutrients. She planted Gliricidia on the farm bunds, allowing its root system to nourish the soil, and used the leaves for making compost.



Photo: S Gouda, ICRISAT

Reaping benefits

Ms Sheela's once barren land is now a cultivable farm. She grows horticultural and plantation crops along with agricultural crops such as cotton and paddy and provides year-round employment to three women.

After observing the benefits of improved management practices, fellow farmers are eager to learn from her. She shares with them her experiences on different aspects of soil health, organic farming, vermicomposting, and balanced nutrient management.

Ms Sheela follows a diversified multiple cropping system, and supplies vegetables for sale in the village to earn a daily income. In addition, she runs a dairy farm, a fish farm and a flour mill.

The Bhoochetana Plus project

Ms Sheela Sikandur played an active participatory role in this project in 2014. She conducted pigeonpea and groundnut varietal evaluations in her field.

Bhoochetana Plus is a multidisciplinary, multi-departmental approach that utilizes the expertise of different international CGIAR organizations.

The interventions in Raichur, Karnataka for 2013-14 include

- Crop diversification with high-value vegetables – AVRDC (The World Vegetable Center)/ICRISAT
- Direct seeded rice for minimizing water use – International Rice Research Institute (IRRI)
- Popularizing water impact calculator for scheduling need-based irrigation – International Water Management Institute (IWMI)/ICRISAT
- Pilot experimentation for demonstrating minimum tillage benefits for sustainability – International Maize and Wheat Improvement Center (CIMMYT)/ICRISAT
- Crop diversification using groundnut and other high-value pulses – ICRISAT
- Efficient use of phosphorus through improved nutrient and crop management interventions - ICRISAT/IRRI/CIMMYT



Photo: PS Rao, ICRISAT

Recycling farm waste through vermicomposting.

She supports her husband who works for an NGO in promoting organic farming and is an active member of the village Self-Help Group.

An award winner

Ms Sheela is a respected lead farmer in her village who is looked up to for advice. She received the Progressive Farmer award from the University of Agricultural Sciences, Dharwad during 2012-13.

She was recognized for her work at the Women Farmers Day event held on 12 September 2014 at ICRISAT headquarters.

Project:
Bhoochetana Plus

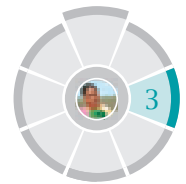
Investor:
 Government of
Karnataka

Partners:
State Agricultural
Universities
Line Departments

IWMI, ILRI, IRRI,
CIMMYT, IFPRI, ICARDA,
ICRAF, AVRDC, ICRISAT



Smart Foods: Nutri-cereals for her



The creation of biofortified pearl millet

To combat anemia in women and children, scientists developed **biofortified pearl millet** high in iron and zinc, which has been adopted by Indian farmers. A fine example of the Lab-to-Land approach.

Timeline

- 1982**
ICTP 8203, an open-pollinated variety of pearl millet, was developed at ICRISAT from selection within an Iniadi landrace from northern Togo.
- 1988**
It was released for cultivation in peninsular India and rapidly adopted by farmers.
- 1995**
At the peak of its adoption it occupied about 800,000 ha (mostly in Maharashtra, Andhra Pradesh, Karnataka, Rajasthan and Uttar Pradesh).
- 2003-08**
The variety had the highest level of iron density among a diverse range of populations. By exploiting intra-population variability for iron density within it, one of its improved versions ICTP 8203 Fe was developed with active support of HarvestPlus.
- 2010-11**
ICTP 8203 Fe had 71 ppm of iron density (9% higher than ICTP 8203) and 2.21 t/ha of grain yield (11% higher than ICTP 8203).
42 field trials were conducted by the All India Coordinated Pearl Millet Improvement Project in peninsular India.
- 2012**
Mahatma Phule Krishi Vidyapeeth, Rahuri, had proposed this variety for state release as *Dhanashakti*.
Nirmal Seeds company produced and marketed truthfully labeled seed of ICTP 8203 Fe.
- 2013**
On 15 April, ICTP 8203 Fe was released as *Dhanashakti* in Maharashtra, India.
Bioavailability studies among young women aged around 20 years in Benin and with very young Indian children (aged around 2.5 years) – showed that biofortification of pearl millet is highly effective in combating iron deficiency in millet-consuming populations.
- 2014**
***Dhanashakti* is the first iron biofortified crop cultivar to be officially released in India. It has been included in the Nutri-Farm Pilot Program launched by the Indian government.**
- 2015**
Private sector takes up pearl millet biofortification breeding programs.
A study funded by HarvestPlus released in May, based in Maharashtra, India, has found that of the children (12-16 years) who were iron deficient at the beginning of the study, 40% of the children consuming regular pearl millet and 64% of the children consuming high-iron pearl millet were iron replete at the end of the study. ([Journal of Nutrition](#)).
- 2016**
10 high-iron hybrids (with >80 ppm Fe) are set for **all-India trials**. ICRISAT's biofortification team is expecting to commercialize three more hybrids by 2016.



Photo: J Kane-Potaka, ICRISAT

A woman farmer harvesting pearl millet in Gujarat, India.

Fighting anemia

India: Every second Indian woman is anemic and one in every five maternal deaths is directly due to anemia*. Pearl millet biofortification opens up the possibility of a **cost-effective strategy to beat micronutrient malnutrition in women and children.**

Anemia in women and men in India*



55%



59%



24%

*Source: National Family Health Survey (NFHS-III), 2005-2006

Global scenario: Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the population. The greatest number of individuals affected is non-pregnant women (468.4 million).

The highest prevalence is found in Africa (47.5%) and in South-East Asia (35.7%).

Source: Global Database on Anaemia, Geneva, World Health Organization, 2008.

Pearl millet provides smallholder farmers a climate-ready crop to face the vagaries of climate change. It is a hardy, drought-tolerant crop, often the only crop that can grow in the arid degraded soils across the drylands of the world. It is a staple grain across many states of India and across large parts of sub-Saharan Africa. It is a significant source of iron and zinc and has been shown to account for 19-63% of the total iron and 16-56% of total zinc intake from all food sources in pearl millet growing states of Maharashtra, Gujarat and Rajasthan in India. It is also the cheapest source of these micronutrients as compared to other cereals and vegetables.



Photo: J Kane-Potaka, ICRISAT

How to make a millet chapati – see (<https://youtu.be/Hv7vHBWkklQ>)

Project:

A genetically enhanced pearl millet with high grain iron density for improved human nutrition in India

This work is now incorporated as part of the

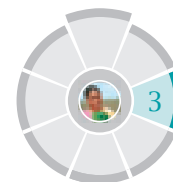


Investor:



Partners:

<http://www.icrisat.org/newsroom/latest-news/happenings/happenings1668.htm#3>



Sowing seeds of prosperity

A success story from Malawi

About 49% of seed producers in Malawi are female. The Phalula Women's Group plays an important role in increasing certified legume seed supply in the country.

Challenge

Farmers had limited access to improved high-yielding and fast-maturing varieties of groundnut and pigeonpea.

Interventions

About **1,000 seed producers** per year have been engaged with approximately **49% being female** producers.

The **seed is bought back by ICRISAT** using funds from the Seed Revolving Fund.

The **Seed Revolving Fund** is treated as a business account. All decisions made, including pricing, are business focused.

More than 16 training programs on **Seed Sector Development** were organized to equip stakeholders to efficiently handle their seed business. **Women's participation ranged from 20-50%.**



Phalula Women's Group, Malawi.



Impact

High-quality certified seeds are flowing into the seed value chain.

Many farmers started growing pigeonpea due to availability of improved seeds, replacing crops such as tobacco.

Farmers collectively monitor the quality of the seed production in each other's fields.

Engaging farmers in seed production and establishing the seed revolving fund overcame the barrier of the private sector's reluctance to engage in production of self-pollinated legume crops.

Farmers involved in the project acquired assets and children have been sent to better schools.

Smallholder farmers benefited from new interventions as the training provided a common platform for upcoming local seed companies, agro-dealer umbrella organizations, Ministry of Agriculture and Food Security, contract growers and smallholder farmer groups.



Photo: Felix Sichali, ICRISAT

A truck loading groundnut foundation seed from an ICRISAT dispatching warehouse in Malawi.

Important market-linked strategies



The future

Phase II

Focus is on building the Malawi Seed Alliance which will take over the project.

Collaborations will be formed with other research and development partners to scale-up and replicate this successful seed model to other crop species.

Innovative models for grain marketing will be developed targeting the trade and consumer markets.

“ From 2008 to 2013, these investments have increased legume certified seed supply in the country from 270 tons to 2,405 tons, an **8-fold increase**. **Over 2 million farmers have been reached with this seed**. We have ramped up seed production, increased storage capacity, and indeed now for the first time, have a seed system management information system in the country.

Ms Áine Hearn
Irish Ambassador to Malawi



Project:
Malawi Seed Industry Development Project

This work is being undertaken as part of the



Investor:
Irish Aid

Partners:
Seed Services Unit of the Ministry of Agriculture and Food Security, Seed Trade Association of Malawi, Agri-Inputs Suppliers Association of Malawi, Rural Market Initiative, National Smallholder Farmers Association of Malawi.

Climate-smart women

Snapshots from Madhya Pradesh, India

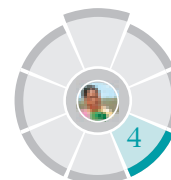


Photo: V Nagasrinivasa Reddy

Hari Bai of Siyalwada village, India.

On-farm and off-farm diversification help women from Siyalwada village in Madhya Pradesh withstand the shocks of climate change. The Self-Help Groups they have formed equip them financially to diversify their farms.

The challenge Scenario in 2010






- CROPS**  **A single crop** a year was the norm in Siyalwada village.
- WATER**  **Water scarcity** was a stark reality though the village received abundant rain (mean annual rainfall is 1,050 mm).
- SOIL**  The **soil was denuded and depleted** of nutrients. During the monsoons, rainwater from the nearby hills rushed down the slopes destroying crops and leaving the soil eroded.
- PEOPLE**  **Migration** to neighboring villages in the off-season to work as farm laborers was common.
- WOMEN**  **Lack of education and exposure** meant women from the Gond tribe were afraid of interacting with outsiders. Many of them had never travelled beyond their village. The women farmers in this study travelled by train for the first time in 2014, to attend a field day at ICRISAT-India.



Photo: V Nagasrinivasa Reddy

Puja Self-Help Group.

Interventions

Self-Help Groups played a key role

- ▶ **Socio-economic survey** was conducted to identify poor and landless women.
- ▶ **Women were motivated** to form Self-Help Groups (SHGs). The groups provided low interest loans allowing the women to invest in diversification of their farms and create more income sources.
- ▶ **Diversification of farms** was an integral part of the watershed projects. SHGs played a key role in introducing and implementing various activities such as:
 - Livestock farming
 - Vermicomposting
 - Flour mill/stores
 - Introducing new crops.

Impact

DIVERSIFYING FARMS

Income-Generating Activities

Goatery

I availed a loan of ₹2,000 (\$32) from Shiv SHG in 2010, and bought my first goat. I now have ten goats. The goats sell anywhere between ₹5,000–9,000 (\$81–145)
 – Hari Bai



<https://www.youtube.com/watch?v=WWu2IvyBW7g>

Flour mills & vegetable farming

“Multi-cropping has enhanced my earnings. I first purchased a small mill and later a bigger mill. I earn ₹150-200 (\$2-3) in a day. I also have a vegetable patch. The crop was good. I sold some in the market for ₹20 (\$0.31) a kilo and bartered some for wheat. – Sarda Bai



<https://www.youtube.com/watch?v=vgt1sAcZkiQ>

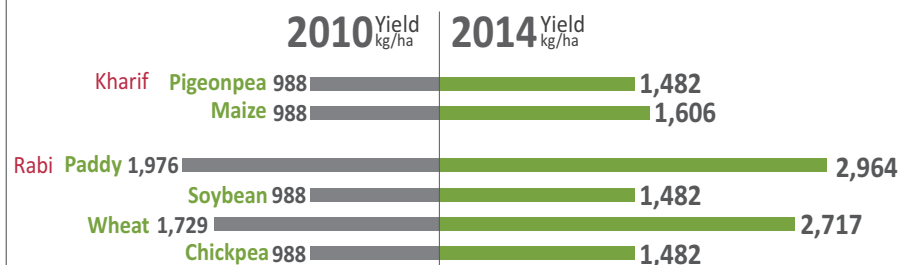
DIVERSIFYING CROPS

New crops: Rice was grown here for the first time in 2014.

Yearlong farming: Farmers grow cereals and lentils all year round.

Better yield: Cropping intensity increased from 115% to 160%.

Average yield of crops after water harvesting and nutrient management



Project:

9 Model Watershed projects, Raissen District, Madhya Pradesh

This work was undertaken as part of the



Investor:

Ministry of Rural Development Government of India

Partner:

Bhopal Yuwa Paryavaran Shikshan Samajik Sansthan (BYPASS) Bhopal, MP

Her opinion matters

A Southeast Asia project sets an example

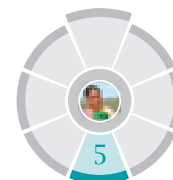


Photo: PM Gaur, ICRISAT

A farmer in Vietnam showing an improved variety of groundnut.

Scientists and extension workers are actively seeking the participation of women in devising on-farm strategies. This project illustrates the benefits reaped through gender inclusivity.

From selecting crop varieties that met their requirements to updating farming and business skills through trainings on improved crop and seed production practices, women farmers in Vietnam, Laos, Nepal and India played a key role in improving the productivity and sustainability of rainfed agriculture in their respective project regions.

On-farm practices and technologies introduced in 2014

- Intercropping with grain legumes
- Improved farm practices
- New/improved crop varieties
- Integrated Pest Management
- Seed treatment
- Community-based seed production groups for treating and storing seed
- On-farm technologies for income-generation activities.

Gender component in trainings:

Among the 3,000 farmers and extension workers trained to facilitate adoption of new technologies, close to 50% were women.

Participation of women in trainings was monitored and efforts are being made to increase their involvement in Laos and the Indian state of Madhya Pradesh where participation is low.

Family farming initiatives involve women:

In Rajasthan 4,650 households

cultivated improved pearl millet hybrids

In Vietnam 248 households

cultivated improved mung bean

Project Highlights

India

Rajasthan

- A Farmer Field School was launched. Lead women farmers outnumbered men (527 vs 51). They took the lead in the demonstration of crops and helped other farmers (10-15 each). Farmers were exposed to new varieties and practices. The leaders met with Self-Help Groups (SHGs) regularly.
- Women play a vital role in farm operations and taking decisions on what crop and variety to grow. Women SHGs are involved in procurement and distribution of farm inputs.
- Introduced improved pearl millet varieties and intercropping of pearl millet with moth bean/green gram or with green gram/sesame/cluster bean.

Jharkhand

- Women SHGs took up seed production: Chickpea: 55 SHGs; groundnut: 62 SHGs; pigeonpea: 177 SHGs.
- Farmers get 20-25% higher yields due to improved cultivars.
- Improved varieties of chickpea, pigeonpea and groundnut were introduced.
- Communities took up feed production for livestock.

Madhya Pradesh

Women farmers were given training in preparing snacks from legumes, soymilk, and pickling of local low-cost fruits like *Phyllanthus emblica* (amla) and *Ziziphus mauritiana* (ber). Machines were provided for food processing. These products added to the household's nutritional security as well as helped the women earn additional income.

Farm practices introduced:

- Chickpea treated with molybdenum (Mo), showed 22-25% yield increase.
- Chickpea and lentil treated with biofungicide had a yield advantage of 17%.
- Ridge planting of pigeonpea prevented waterlogging and phytophthora disease giving 27% higher yield.
- Intercropping of pigeonpea with soybean was introduced.



Photo: PM Gaur, ICRISAT

Women Self-Help Groups in Nepal.

Vietnam

Women farmers play an active role in the choice of crop varieties, seed production and sales.

- Improved varieties of green gram and soybean earned about \$720-838 per ha above the local variety.
- Intercropping of maize with groundnut was introduced.
- The local government in Cao Bang province plans to advocate cultivation of green gram in summer season.

Nepal

Women farmers formed 12 community-based seed production groups. They were supplied seed and storage bins. They were trained in preparation of snacks and provided bag-sealers, plastic bags and other equipment needed to start a mini agro-enterprise.

Farm practices introduced:

- Integrated Pest Management for pod borer gave up to 50% increase in chickpea yield.
- Promotion of micronutrient-rich lentil lines was conducted in six farmers' fields.
- Lentils treated with molybdenum had enhanced yield of 25-30%.
- Intercropping of maize with groundnut and pigeonpea was also introduced.

Laos

Seed production farmer groups headed by women were identified and provided training in groundnut seed production and initial funding.

Farm practices introduced:

- Dry season cultivation of groundnut increased yield of wet-season rice by 50% (additional income of about \$614 per household).
- A seed drying house was constructed.
- Chickpea and pigeonpea are new crops.
- Intercropping of maize with groundnut was started.

Project:

Sustainable management of crop-based production systems for raising agricultural productivity in rainfed Asia

This work was undertaken as part of the

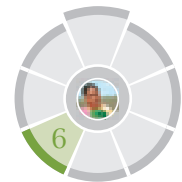


Investor:



Partner:

<http://www.icrisat.org/newsroom/latest-news/happenings/happenings1678.htm#1>



Game for innovation

Women in India and Africa try out new technologies

Be it for a healthy snack for kids or preparation of eco-friendly bio-charcoal, introducing processing empowers women to find a market for innovative sorghum products.

INDIA

Off-farm initiatives

A booklet triggers a venture

Dibyajyothi Borgohain, a first-time entrepreneur talks of her agribusiness start-up – Ind-Millet Foods...

“ It started off a year and half ago when my friends and I were looking for business avenues for healthy snacks for kids. The ICRISAT Agribusiness and Innovation Platform (AIP) stall at an exhibition had an interesting booklet. We wrote to AIP evincing our interest.

Lab visit

A lab visit was arranged for us. We went through the products and opted for sorghum crispies. You can't stop kids from eating fried crispies available in the market, so we thought of giving them a healthier option in the form of baked sorghum crispies.

Testing times

With guidance and technical support from AIP we created a product which we tested in schools, exhibitions and carnivals. It took us eight months to work out the product. We made five batches modifying the composition based on feedback and market surveys of similar products available in the market. Size, taste and the level of crispiness were the major factors that we worked on.



Photo: S Punna,

Dibyajyothi Borgohain, Madhavi Pomar and Jayanthi Satram.

Technical backstopping from AIP

My partners Madhavi Pomar and Jayanthi Satram and I are homemakers and first-time entrepreneurs. **After managing our homes for years, we felt we could manage anything! And we did it with ICRISAT's support.**

Future plans

Once we develop a good market for the product we want to procure

the raw material directly from the farmers. We want to create more opportunities for other women.

[Watch video - www.youtube.com/watch?v=mjO2hH5aArY](http://www.youtube.com/watch?v=mjO2hH5aArY)





Photo: ICRISAT

Food processing attracts youth: These sorghum and pearl millet processors based in Nairobi are ICRISAT's partners.

Services provided by ICRISAT-AIP

The sorghum crispies were developed by the AIP- NutriPlus Knowledge program lab in 2012-13

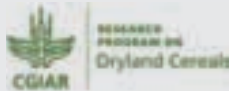
In mid-2013 entrepreneurs were oriented on developing a business plan and test marketing the product.

The product was customized for Ind-Millet in 2014. Innovation and Partnership program helped with label designing and packaging

Registration with Ministry of Micro, Small and Medium Enterprises (MSME) and the Food Safety and Standards Authority of India (FSSAI) license were facilitated

The activity was supported by CRP Dryland Cereals.

This work is being undertaken as part of the



More on AIP: <http://www.aipicrisat.org>

AFRICA

On-farm initiatives

Use of sorghum in bakery and as bio-charcoal

Women farmers in Kano, Nigeria, were trained on benefiting from technologies for enhancing the sorghum value chain. The workshop for trainers focused on using sorghum in making bakery products like bread, cakes, cookies, biscuits and a local product called *gurasa* (flat bread) and producing bio-charcoal.

Sessions dealt with topics like food safety practices, hygiene, sanitation, and entrepreneurship. The training aimed to build the capacity of rural women to actualize the objective of Nigeria Sorghum Transformation Value Chain (STVC) in reducing poverty, improving food security, nutrition and health of women and children.

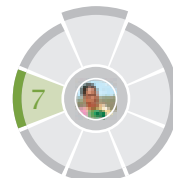
ICRISAT and STVC used the opportunity to link up with Africent Integrated Trade Microfinance Cooperative Society. The society provided training on carbonizing of agricultural waste product to make bio-charcoal. Large-scale adoption of this technology will help reduce the level of deforestation in semi-arid regions since women could use bio-charcoal as an alternative source of energy for household use as well as income generation.



Photo: ICRISAT

This women's group in Nigeria sells bread, cakes, biscuits and other traditional dishes made from millet, sorghum and groundnut. About 1,200 women from 60 groups were trained on use of sorghum for household utilization and income generation as part of the STVC project.

Seed producers get market-savvy



Women in Niger bag the best deals

In Niger the major producers and processors of groundnut are women. Now they are also major marketers, thanks to the facilitators who motivated seed companies to sign contracts with women's associations.

74%
of groundnut seed producers in Niger are women

Challenge

More than 27 farmer association seed producers, totaling 870 members (640 women and 230 men) in the Dosso region of Niger have been working with ICRISAT through the Tropical Legumes II project, since 2007, to evolve and develop –

- ▶ Access to modern varieties
- ▶ Training in seed production technologies
- ▶ Access to inputs (such as varieties, good quality seed and fertilizers) and **production market** for groundnut seed by linking women seed producers to the market.

Interventions

2007-2009

Participatory variety selection trials for **5 groundnut varieties**

- 4 modern varieties: RRB, J11, ICG9346 and Fleur 11
- One local check: 55-437

Access to new varieties

2009-2010

2,500 women trained in seed production technologies in 5 years

2011-2012

100 women seed producers trained in small-scale business management

Building capacity

2012-2013

Stakeholder meeting: Women associations signed **formal contracts with seed companies MANOMA, AINOMA, Alheri and FUSA'A** at the beginning of the cropping season.

Credit: ICRISAT **provided inputs for seed production to women on credit** at the beginning of cropping season, which would be reimbursed in kind at harvest time.

Guaranteed price: Women received **a guaranteed price of 30% above ongoing market price** at the time of purchase.

Timely purchase: Seed companies purchased seed in a time-bound manner.

Contracts work: **Contracted amount of 50 tons was honored** by seed companies.

Women oriented market development

2013-2014

Seed companies signed 10 contracts on 80 ha of groundnut in 2013/14 with women seed association producers.

Marketing strategies

Sale of seed in small packs
64% of groundnut stock was sold in packs starting from 5 kg onwards.

Treated seed
69% of the treated seed was sold.

Tapping the local market
Farmers who accessed local markets sold about **79%** of their seed stock while those who sought far-off markets sold 40% of their stock.

Contracts
Interlinked contracts with **4** seed companies were set up.





Photos: Dr Jupiter Ndjeunga, ICRISAT

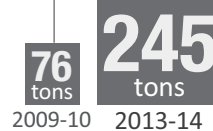
Women groundnut seed producers in Niger. (Inset) A seed company agent of MANOMA weighing a groundnut bag to ensure that it met the norm of 40 kg.

Impact

Women produced **72%** of the total groundnut seed in Niger



Seed production increases over 3 fold in 5 years



\$45 Gross profit

Each farmer produced 5.31 bags (40 kg each) per ha and earned 21,240 FCFA (\$45).

Three small goats can be purchased with this amount.

The Future

Seed companies aim at

500 ha

of groundnut in the next two years

Building on the achievements and the strong gender perspective of the Tropical Legumes (TL) II project, the TL III project has a component on **Gender Learning, Mainstreaming and Analysis** that includes establishment of a gender monitoring system module capable of reporting on gender empowerment and female participation in decision-making as per the CGIAR Research Program on Grain Legumes gender monitoring system.

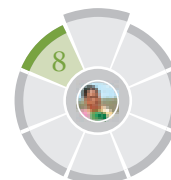
Project:
Tropical Legumes II

This work is being undertaken as part of the



Investor:
Bill and Melinda Gates Foundation

Partner:
for full list of partners see IMOD-Exemplars Vol 1 <http://www.icrisat.org/pdf/>



Creating a market for her

Innovation Platforms in Zimbabwe make it possible



Photo: AF van Rooyen, ICRISAT

Developing a functional market where women could sell their goats was a key component of the project strategy.

Low reproductive rates, high mortality, poor condition and breeds of animals resulted in low market prices. Get to know of the strategies deployed that helped women sell their goats for a good price.



Challenges

Goat markets were poorly developed. Transaction cost for all stakeholders were very high, resulting in low income/profits.

Poor dry season feeding limited the number of animals a household can offer for sale due to low reproductive rates and a high mortality rate.

Poor condition and breeds of animals resulted in low prices at informal markets.



The Strategy

Emphasis was on establishing **functional markets and improving mortality rate** as opposed to addressing productivity and improving breeds.

Work was undertaken along the **value chain** to provide both the incentive and the cash to make the investments to improve productivity.

Setting up an **innovation platform** involving all relevant stakeholders to address market challenges, establish the needs of market intermediaries to reduce transaction costs so that new market strategies benefit all involved – ensuring long-term sustainability.

Production challenges focused on **dry season feed, animal housing** and **veterinary challenges**.

Everyone worked towards **complementary objectives** so that the multi-stakeholder team could address their core business and together address the functioning of the larger system.



Photo: AF van Rooyen, ICRISAT

Leguminous fodder crops such as mucuna, provide excellent opportunities to increase dry season feed for goats while significantly improving soil fertility. Mucuna is mixed with cereal crop residues to increase the dry season feed supply, significantly reducing mortalities during the dry season.

Impact

2014 results

- ▶ **Goat mortalities were reduced** from >18% to <10% through the development of markets and better management of animals.
- ▶ **Profitability of goats increased** with on-farm interventions by \$1.50 per animal, while market interventions increased per animal profitability to more than \$10.
- ▶ **Women invest income in family** and use the cash to pay for education and human health related expenses and as a buffer against farming-related risk.

Future Challenges

Feed Systems: Dire need for commercialization of feed production and to improve the local feed system by increasing legume component and simultaneously increasing soil fertility.

System integration: Greater integration between crops, livestock and markets can be achieved through use of dual-purpose crop varieties.



Project:

Lili Markets YEU04 2007-2010; Goat Production in Zim (EU/ORAP) 2008-2010; CPWF, Challenge Program for Water and Food 2010 to 2013; IFAD YEU12 Dec 2010 to May 2014.

This work is being undertaken as part of the



RESEARCH PROGRAM ON Dryland Systems

Partners:

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**International Crops Research Institute
for the Semi-Arid Tropics**



ICRISAT is a member
of the CGIAR Consortium

We believe all **people** have a **right** to **nutritious food** and a **better livelihood**.

ICRISAT works in agricultural research for development across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

We work across the entire value chain from developing new varieties to agri-business and linking farmers to markets.

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