The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a pioneering, international non-profit scientific research for development organization, specializing in improving dryland farming and agri-food systems. The Institute was established as an international organization in 1972, by a Memorandum of Agreement between the Consultative Group on International Agricultural Research and the Government of India. ICRISAT works with global partners to develop innovative science-backed solutions to overcoming hunger, malnutrition, poverty, and environmental degradation on behalf of the 2.1 billion people who reside in the drylands of Asia, sub-Saharan Africa, and beyond.

www.icrisat.org
ICRISAT is proud to be celebrating its 50th anniversary in 2022, which was inaugurated in early February by the Hon. Prime Minister of India, Shri Narendra Modi. The Institute’s illustrious history has been one defined by scientific research and partnerships which have delivered numerous world firsts in reforming dryland agri-food systems. These breakthroughs are among the most tangible impacts of all development interventions in overcoming poverty, hunger, malnutrition and environmental degradation for many of the 2.4 billion who call the drylands of Asia, Africa and beyond home. The awarding of the Africa Food Prize 2021 to ICRISAT is a testament to our impacts and contributions to the Sustainable Development Goals. The challenges facing the drylands are inextricably linked so our focus lies not only within the domain of agricultural science, technology and innovation but the social, institutional and structural requirements of smallholder dryland farming. Our work also has a nation building imperative. We invite you to partner with us on this journey.

From playing a passive role in economic development, the agricultural sector and the rural economy must now have a strong and dynamic role in the overall economic development strategy of developing nations. As a global knowledge leader, ICRISAT looks to the next 50 years with confidence that a brighter future can be created for the myriad of dryland communities whom we serve. We invite you to partner with us on this journey.

ICRISAT’s unique expertise in the management of dryland ecosystems and genetic improvement of nutritious grain legumes and dryland cereals that tolerate the vagaries of climate change, make it an essential partner for research and development to achieve improvement of nutritious grain legumes and dryland cereals that tolerate the vagaries of climate change, make it an essential partner for research and development to achieve.
ICRISAT’s mission is to reduce poverty, hunger, malnutrition and environmental degradation in the dryland tropics.

Vision

Prosperous, food-secure and resilient drylands.

Value Proposition

ICRISAT brings scientific, evidence-based solutions to agriculture and food systems in the drylands with a special focus on sub-Saharan Africa and Asia. The Institute is recognized as a global knowledge leader and holds 50 years of multi-disciplinary knowledge, experience and expertise in solving some of the most pressing issues facing the drylands. The Institute has a wide range of global, regional and local networks and an inclusive partnership approach to developing innovations to deliver at scale.

Mission

2013
High-iron biofortified pearl millet variety Dhanashakti developed by ICRISAT is released in India to address micronutrient deficiency

2016
The first genome code for cultivated groundnut is mapped

2016
ICRISAT bred first machine-harvestable chickpea variety NBeG 47 released in India reducing manual drudgery

2017
ICRISAT led the sequencing of the pearl millet genome

2018
Africa’s first biofortified pearl millet variety chakti developed by ICRISAT is released by the Government of Niger for commercial cultivation

2021
ICRISAT receives the prestigious Africa Food Prize for its work in improving and disseminating legume varieties for enhanced food security in sub-Saharan Africa
About us

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a pioneering, international scientific research for development organization, specializing in improving dryland farming and agri-food systems. The Institute was established as an international organization in 1972, by a Memorandum of Agreement between the Consultative Group on International Agricultural Research and the Government of India.

ICRISAT works with global partners to develop innovative science-backed solutions to overcome hunger, malnutrition, poverty and environmental degradation, serving the 2.1 billion people who reside in the drylands of Asia, sub-Saharan Africa and beyond. The Institute is headquartered in Hyderabad, Telangana, India and has regional centers in Mali and Kenya, with dedicated research stations in Niger, Nigeria, Malawi, Ethiopia, Zimbabwe, Mozambique, Tanzania and Senegal.

ICRISAT’s areas of specialization include:

• A deep understanding of the issues and challenges inherent in the drylands which exhibit some of the harshest environments globally. These socio-physical environments contribute to consistently low human development outcomes and pose profound challenges to attaining the UN Sustainable Development Goals.
• A focus on the most resilient, climate smart and nutritious legumes and cereal crops critical to the drylands – chickpea, pigeonpea, groundnut, sorghum, pearl millet, finger millet and small millets.
• A collection of one of the broadest diversities of genetic resources of our speciality crops which are used to enhance the crops with which we work.
• Recognized world class research across a wide array of specialities ranging from genomics, gene editing, modern crop breeding, natural resource management, seed systems, climate smart agriculture, digital solutions to informing policy on improved markets and institutions.
• A web / value chain approach with vast experience across agricultural production systems and food value chains.
• A strong focus on delivery and innovations at scale.
• A profound understanding of the interventions required to attain the UN Sustainable Development Goals related to our mission.
ICRISAT undertakes advanced scientific agricultural research to overcome poverty, hunger, malnutrition and environmental degradation to improve the livelihoods and well-being of more than 2.1 billion people who call the drylands home. The challenges in the drylands are inextricably linked, and thus the Institute adopts a holistic approach to overcoming them. The Institute has a particular focus on social inclusion and empowering women along the agricultural value chain.

ICRISAT’s research approach includes:

- A systems perspective to ensure the most pressing issues are addressed
- A market-oriented focus to making farming more profitable
- A commitment to evidence-based solutions
- A multi-disciplinary approach to opportunities and to finding solutions to challenges
- A focus on environmental and business sustainability models
- A participatory approach and integrating training and capacity building with key stakeholders
- A focus on local, regional and global partnerships across regions to maximize knowledge sharing, capacity building and solutions for our stakeholders

For 50 years, ICRISAT’s expertise has delivered world firsts that continue to have global impacts on reducing hunger, poverty, malnutrition and environmental degradation for local communities across Asia and Africa.

Our work is framed by the Sustainable Development Goals with a particular focus on Goals 1, 2, 5, 13 and 17.
Overcoming Hunger and Malnutrition
Central to ICRISAT’s work is overcoming hunger, especially among the most vulnerable. Our scientific research is designed to increase both nutritional quality and quantity of food available through increased crop yields.

Overcoming Poverty
We create long-term science-backed solutions to overcoming poverty in the drylands by helping smallholder farmers transition from subsistence farming to surplus farming and making farming more profitable.

Addressing Climate Change
Climate change is arguably one of the greatest challenges facing agricultural production in the drylands of Africa, Asia and other parts of the world where crop seasons are short and rainfall is highly variable. ICRISAT works with multiple partners to develop climate resilient dryland crops through an array of climate-smart technologies.

Championing Gender Equality
ICRISAT recognizes that women make up more than half the work force in smallholder dryland farming. Gender is a cross cutting theme across all of our work with the aim of empowering women in social and economic participation and decision making at all levels.

Partnerships
ICRISAT leverages strategic partnerships to capitalize on the natural synergies and expertise between organizations for greater impact. One of our strengths is the depth and diversity of our partnerships across the public and private sectors.
3 Research Specialities

As an international knowledge leader in dryland agri-food systems, our scientific expertise and non-partisan approach is globally recognized as having produced world firsts and resulted in some of the most innovative solutions to overcoming hunger, poverty, malnutrition and environmental degradation.

ICRISAT’s research impacts span the entire value chain:

Germplasm, pre-breeding, breeding and seed systems

Enriching cultivated crop gene pool diversity by utilizing distantly related germplasm such as exotic landraces and crop wild accessions.
Introgression of genes/quantitative trait loci (QTLs) to enhance productivity, biotic and abiotic stress tolerances, nutrition and climate resilience.
Identifying consumer-preferred and demand-driven traits to develop crop product profiles for targeted breeding.
Optimizing and deploying novel breeding methods to develop superior varieties and adopting speed breeding technology/rapid generation advancement technology.
Working with national partners to release improved varieties and developing and evaluating more efficient and cost-effective seed supply options through better institutional arrangements.

Genomics, systems biology and crop informatics

Developing genomic resources, low-cost genotyping technologies and decision support tools.
Identifying valuable and novel alleles and haplotypes with traits for climate resilience, nutrition, and consumer preferences.
Multi-omics approaches to understanding the mechanisms of complex traits for crop breeding.
Machine learning to integrate data from multiple sources to develop predictive models.

Genome editing and molecular biology

Genome edited approaches and gene editing for intractable traits in ICRISAT’s mandate crops.
Developing protocols for generating double haploids and other new breeding tools and technologies.

Crop physiology, crop protection and modelling

The use of modelling tools and precise, high-throughput phenotyping to identify drought and heat tolerance traits to assist in breeding for difficult environments and future climate predictions.
New, innovative and environment-friendly methods for crop protection, including the use of non-invasive techniques for phenotyping and the application of nanomaterials.
Tracking the emergence of new diseases and pathogen variability for existing and emerging diseases.
Enabling modelling tools to assess cropping system productivity under a variety of conditions.

Socioeconomics

System dynamics modelling to analyze food chain complexity, mapping and assessing efficiencies in agricultural value chains/web and understanding the behavioral dimensions of the dynamic linkages between agri-food value chains and nutrition.
Ex-ante assessments and scenario development to estimate the economic and other value of future and emerging crop traits linked to market demand for breeding prioritization.
Studying value chain and food systems to support biofortification and the integration of emerging high value traits (e.g. high-oleic acid groundnut) through demand creation and value chain development.
Studying developing markets and institutions for a more productive agriculture sector.

Systems-based sustainable natural resource management

Watershed and community-based approaches to scaling water harvesting, land restoration and livelihood interventions.
Scaling climate-smart agricultural interventions linked to climate risk assessments.
System behaviour predictions and designing appropriate interventions to increase crop quantity and quality.
Digital innovations and technologies

Creating new opportunities to integrate smallholders into digitally supported agri-food systems. Applying information, communication and digital technologies to bring innovations to extension systems, farm management, climate risk adaptation and markets.

Geospatial and big data

Mapping dryland areas, crops and cropping systems and developing spatial products, climate analysis to predict future responses, land degradation assessment, yield and yield loss assessments.

Interdisciplinary research

The challenges inherent in the drylands are multifaceted and inextricably linked. In response, ICRISAT adopts a systemwide approach through its interdisciplinary research as the most effective way to tackle complex challenges. Some areas include climate resilience, nutrition and natural resource management.

Crop diversification

ICRISAT’s work on crop diversification hinges on three objectives: improving livelihood options for the farmer, the effective use of scarce water resources and sustainability. The ICRISAT developed Sahelian Eco-Farm is a cropping system in which trees and/or shrubs are intercropped with annual crops to combat soil erosion, low soil fertility, low water use efficiency, droughts, insufficient supply of animal feed, low income and inefficient distribution of labour. Similarly, the African Market Garden - a low-pressure drip irrigation system, combined with a comprehensive crop husbandry package - generates income for small producers, contributes to better nutrition and helps mitigate the effects of climate change.

Crop-livestock integration

The institute has an extensive track record in improving the efficiency of agronomic and livestock systems for better resilience. ICRISAT-bred forage crops, dual purpose crops and multi-cut varieties offer a means to address fodder shortages and improve livelihoods in dryland farming communities.

In collaboration with the International Livestock Research Institute (ILRI), ICRISAT has carried out joint research on livestock fodder derived from sorghum, pearl millet, legumes and groundnut. In Africa, ICRISAT works to promote livestock production through improved feed, animal health linkages to market and capacity development of farmers.

Biofuels

The use of sorghum and pearl millet as feedstock for commercial biofuel production presents a market opportunity for drylands farmers. ICRISAT, with its partners, has been working on the development of a sweet sorghum ethanol value chain. As a result, sweet sorghum is now an established biofuel feedstock in India, China, Philippines and Brazil. High-biomass pearl millet varieties also present a huge opportunity as a biofuel feedstock.
Our speciality crops

For crop improvement, ICRISAT works to develop and enhance resilient, climate-smart and nutritious legume and cereal crops including chickpea, pigeonpea, groundnut, sorghum, pearl millet, finger millet and small millets. These crops are fundamental to food security in the drylands. At the systems level, ICRISAT also works on other important crops such as soybean, sunflower, sesame, mustard, rapeseed. ICRISAT collaborates with partners on a wide range of cropping systems, agroforestry and livestock.

Sorghum

Sorghum is a genus of about twenty-five species of flowering plants in the grass family that produce edible and nutritious grains. Some of these species are grown as cereals for human consumption and some in pastures for animals. One species is grown for grain, while many others are used as fodder plants.

### Milestones

- **2007**: World’s first ethanol from sweet sorghum (ICSV 25308 and RVICH 28) produced from ICRISAT-bred cultivars
- **1987**: ICSV 112 released in India as CSV 23 and eventually released in 9 countries
- **1978**: First ICRISAT variety released for farming in India (Motil)
- **2012**: First marker-assisted bred sorghum varieties that are Striga tolerant released in sub-Saharan Africa
- **2019**: Forage sorghum hybrid CSH 24 MF is awarded ‘landmark forage hybrid’ in India
- **2016**: High biomass sorghum (ICSSH 28) for production of biofuel
- **2019**: World’s first high iron and zinc variety Parbani Shakti released in India
- **2020**: 3 high-yielding varieties (Pilara 34 and 51) released in Malawi

### Crop Improvement

**Short-duration variety**

- **Short duration**: <100 days to maturity
- **Normal duration**: 100 - 120 days to maturity

**Yield potential (raised areas)**

- Varieties: 3.0 t/ha; Hybrids: 4.0 t/ha
- Current yield: 0.8 t/ha (varieties) 1.2 t/ha (hybrids)

**Varieties/Hybrids developed**

- **3**: Striga resistant
- **1**: Midge resistant
- **2**: Drought tolerant
- **3**: Biofortified (Fe/Zn)

**Other traits**

- Shoot fly resistant
- Stem borer resistant
- Grain mold resistant
- Forage
- Biomass/ethanol

### Varieties released from ICRISAT-origin material

- **333 varieties in 46 countries**

(Map shows top 22 countries. Figures as of 2021)

### Impacts

**Expansion of ICRISAT-origin material**

Seed Production by ICRISAT (2011-2021)

- **21,240.4 tons**
  - **Africa: 17,199.4 tons**
  - **Asia: 4,041 tons**

India: Seed consortium 1.1 million farmers benefited from improved cultivars
Pearl Millet

Among millets, pearl millet is the most widely grown type of millet. It has been grown in Africa and the Indian subcontinent since prehistoric times. Pearl millet is well adapted to growing in areas characterized by drought, low soil fertility, and high temperature. It performs well in soils with high salinity or low pH. Due to its tolerance to difficult growing conditions, it can be grown in areas where other cereal crops, such as maize or wheat, would not survive.
Finger Millet

Finger millet is an annual herbaceous plant widely grown as a cereal crop in the arid and semi-arid regions of Africa and Asia. It has the ability to withstand cultivation at altitudes over 2000 m above sea level, highly drought tolerant, and the grains can be stored for a long time.

Milestones

- **2018**
  High nutrient variety released in Uganda
- **2017**
  Easy harvest variety released in Kenya
- **2016**
  100 promising varieties profiled for calcium, iron and zinc
- **2015**
  - Declared as an ICRISAT mandate crop
  - 3 cultivars introduced in Malawi
- **2014**
  Popular variety U15 released in Tanzania following its success in Kenya and Uganda
- **2013**
  First nutrient profiling done

Crop Improvement

Potential of high-yielding varieties

<table>
<thead>
<tr>
<th>Yield gap</th>
<th>2.0 t/ha</th>
<th>6.0 t/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average yield</td>
<td>Yield potential</td>
<td></td>
</tr>
</tbody>
</table>

Varieties released from ICRISAT-origin material

29 varieties in 7 countries

India, Kenya, Ethiopia, Tanzania, Uganda, Malawi and Zambia

Seed Production by ICRISAT (2011-21)

453 tons of finger millet seeds shared with farmer groups, National Agricultural Research Systems (NARS) and non-governmental organizations

Countries where the varieties (including hybrids) are released

(Figures as of 2021)
Chickpea

Chickpea is an annual legume and a nutrient-dense food with seeds that are high in protein. It is one of the earliest cultivated legumes. Chickpea is a key ingredient in Mediterranean and Middle Eastern cuisines and is important in Indian cuisine.

Milestones

2014
- Popular variety U15 released in Tanzania following its success in Kenya and Uganda

2015
- Declared as an ICRISAT mandate crop
- 3 cultivars introduced in Malawi
- 100 promising varieties profiled for calcium, iron and zinc

2016
- Yield gap: Average yield 2.0 t/ha, Yield potential 6.0 t/ha
- 29 varieties in 7 countries
- 453 tons of finger millet seeds shared with farmer groups, National Agricultural Research Systems (NARS) and non-governmental organizations

2017
- Easy harvest variety released in Kenya

2018
- High nutrient variety released in Uganda

Crop Improvement

Short-duration variety

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration to Maturity</th>
<th>Varieties Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra-early</td>
<td>80-85 days</td>
<td>10 varieties</td>
</tr>
<tr>
<td>Early</td>
<td>100-80 days</td>
<td>Pan-genome</td>
</tr>
<tr>
<td>Normal duration</td>
<td>160 days</td>
<td>3,366 chickpea genomes sequenced</td>
</tr>
</tbody>
</table>

Varieties developed

- 76 Desi type (small seeded with dark colour seed coat)
- 48 Kabuli type (large seeded with beige colour seed coat)
- 4 Machine harvestable
- 2 Heat-tolerant

Expansion of ICRISAT-origin material

- 256,467 Samples of diverse breeding material supplied to 100 countries

Potential of high-yielding varieties

- Yield gap: Average yield 1.2 t/ha, Yield potential 4 t/ha

Seed Production by ICRISAT (2011-21)

- Seed shared with farmer groups, National Agricultural Research Systems (NARS) and non-governmental organizations
- 276,918 tons
  - Asia: 251,467 tons
  - Africa: 25,451 tons

Varieties released from ICRISAT-origin material

- 185 varieties in 27 countries

(Figures as of 2021)
Groundnut

Groundnut is a leguminous crop and an important oilseed crop. It is the sixth most important oilseed crop in the world and a major forage crop. Groundnut is both an oil source and food crop. It is highly nutritious and contains 48-50% oil, 26-28% protein and is a rich source of dietary fiber, minerals and vitamins.

**Milestones**

- **2021**: Kalinga groundnut 101 released to replace 14-year old Devi variety in Odisha, India
- **2020**: First high oleic acid variety (Girnar 4 & Girnar 5) released in India
- **2017**: Two high oil content varieties released - Near aflatoxin tolerant events identified - Groundnut Network Group-Asia (GNG-A) established
- **2016**: First genome code for diploid ancestors of cultivated groundnut deciphered
- **2015**: World's first variety with foliar fungal disease resistance and early maturing properties combined using genomics
- **2010**: Drought-tolerant variety (ICGV 00350) released
- **2008**: Synthetic lines developed to tap novel alleles from wild species
- **1999**: Groundnut rosette virus resistant variety (ICGV-SM 90704) developed
- **1996**: World's first early-maturing variety (ICGV 86015) developed
- **1994**: Large-seeded confectionery variety (ICGV 86564) released
- **1990**: Foliar fungal disease resistant variety (ICG (FDRS) 10) released

**Crop Improvement**

**Short-duration variety**

- Early maturing: 90 - 100 days to maturity
- Normal duration: 105 - 120 days to maturity

**Potential of high-yielding varieties**

- Yield gap:
  - 1.6 t/ha
  - 5.3 t/ha

- Average yield
- Yield potential

**Seed Production by ICRISAT (2011-21)**

Seed shared with farmer groups, National Agricultural Research Systems (NARS) and non-governmental organizations

- **129,730 tons**
  - Africa: 100,600 tons
  - Asia: 29,129 tons

**Varieties released from ICRISAT-origin material**

- **230 varieties in 39 countries**

**Varieties/ Hybrids developed**

- 33 Foliar fungal disease resistant
- 4 Groundnut Rosette Disease resistant
- 20 Drought tolerant
- 3 Confectionery varieties
- 5 Early maturing

Aflatoxin tolerant groundnut (<1ppb 3 days after fungus inoculation) compared to heavily contaminated seeds (over 3,000 ppb).
Pigeonpea is a perennial legume and is widely cultivated in tropical and semi-tropical regions around the world, and commonly consumed in South Asia, South East Asia, Africa, and Latin America. It can be of a perennial variety, in which the crop can last three to five years, or an annual variety more suitable for seed production.

**Milestones**

- **2021**: Improved genome assembly published
- **2018**: High density Axion Cajanus 5R000 SNP array developed for trait mapping
- **2017**: 300 Lines resequenced
- **2011**: Pigeonpea genome sequenced
- **2008**: World's first commercial CMS\(^1\) hybrid (ICPH 1672)
- **2004**: Hybrid Parents Research Consortium formed
- **1992**: World's first wilt and SMD\(^2\) resistant Asha variety (ICPL 87229) developed
- **1991**: World's first pigeonpea GMS\(^3\) hybrid (ICPH 8) developed
- **1986**: World's first Fusarium wilt-resistant variety Maruti (ICP 8863) developed for commercialization

**Crop Improvement**

**Short-duration variety**

- Super early: <100 days to maturity
- Normal duration: 160-180 days to maturity

**Varieties/ hybrids developed**

- 20+ fusarium wilt and sterility mosaic disease resistant

**Potential of high-yielding varieties**

- Yield gap: 0.9 t/ha
- Yield potential: 3.5 t/ha

- Average yield: 2.5 t/ha (varieties)
- Yield potential: 3.5 t/ha (hybrids)

**Seed Production by ICRISAT (2011-21)**

Seed shared with farmer groups, National Agricultural Research Systems (NARS) and non-governmental organizations

- **23,445 tons**
  - Asia: 17,213 tons
  - Africa: 6,232 tons

**Varieties released from ICRISAT-origin material**

- 121 varieties in 19 countries

\(^1\) Cytoplasmic male sterility
\(^2\) Sterility mosaic disease
\(^3\) Genetic male-sterility

(Figures as of 2021)
Small Millets

The ICRISAT genebank conserves small millets such as little millet, foxtail millet, barnyard millet, proso millet and kodo millet and has been instrumental in conserving accessions and distributing seed samples and varieties to national partners.

ICRISAT wrote the first case for the Government of India to highlight how millets are 'good for you, the planet and the farmer'. ICRISAT collaborated with the governments of host countries in Africa to gather support letters for the International Year of Millets. The resolution was later endorsed by the FAO and passed at UN General Assembly declaring 2023 as the International Year of Millets.

ICRISAT has also published a first-of-its kind systemic review on the impact of consuming millets on type 2 diabetes, iron deficiency anaemia, issues around lipid profiles (cholesterol, obesity and hypertension) and calcium deficiency. Prioritizing Regular Intake of Sorghum and Millets (PRISM), is a global survey by ICRISAT in collaboration with Massachusetts Institute of Technology and Indian Institute of Millets Research to understand the potential drivers of sorghum and millet consumption.

Oilseeds

Oilseeds such as groundnut, mustard, sesame, sunflower, rapeseed and soybean are grown primarily to produce edible oils used in cooking and food processing. The income derived from oilseeds provide economic value to exporting nations, contributing significantly to funding various national initiatives. In recognition of their economic importance, ICRISAT is undertaking research into improving the resilience, yield and quality of select oilseed crops in close collaboration with national agricultural research systems and other partners.
Technology and Innovation

ICRISAT is a world leader in developing and employing technology and innovation for the drylands.

Digital Technologies

The Plantix App: Developed by PEAT (Progressive Environmental and Agricultural Technologies), Germany, in collaboration with ICRISAT and the Acharya N G Ranga Agricultural University, Hyderabad. The application helps farmers identify crop pests and diseases and suggests solutions. All pictures sent using the app are geo-tagged, thereby enabling real-time monitoring of pest and diseases.

The Sowing App: Developed through a partnership between ICRISAT, Microsoft and the Andhra Pradesh government, the app helps farmers achieve optimal harvests through SMS on the best time to sow crops depending on weather conditions, soil and other indicators. Advice is delivered in local languages.

STARS-One Android App: Developed by MANOBI S.A., ICRISAT and other STARS partners which streams remotely sensed diagnostic metrics on crop performance, soil fertility, and yield gaps for individual smallholder fields.

The Intelligent Agricultural Systems Advisory Tool (ISAT): Developed between ICRISAT, Microsoft, Indian Meteorological Department and the Acharya NG Ranga Agricultural University, ISAT provides concise SMS farm advisories. Messages are generated after analysis of local and global historical climate data, current and forecasted weather conditions, crop systems and soil-related information.

Nurturing Africa’s Digital Revolution for Agriculture (NADiRA): An innovation to develop agriculture in Africa using sustainable digital farming solutions. It includes Earth Observation products, Internet of Things data and mobile devices giving stakeholders meaningful big data and information to improve smallholder farming.

Aflatoxin Management

ICRISAT and its partners have extensive experience in aflatoxin management and have developed several technologies that can reduce the risks of aflatoxin contamination. These technologies include tolerant cultivars, best harvesting and drying techniques, the application of lime, farmyard manure and crop residues.

Mobile, low-cost aflatoxin detection technology: ICRISAT developed a compact and portable kit based on the lateral flow immunoassay test. This simple and economical non-laboratory-based kit can be used directly by farmers, agro-dealers, public health authorities and food processors to detect aflatoxin in groundnuts to manage and reduce the entry of aflatoxins into food value chains.

Aflatoxin testing assay: ICRISAT developed a simple and economical testing assay to detect aflatoxins using polyclonal and monoclonal antibodies. The test uses a competitive enzyme-linked immunosorbent assay (cELISA) to rapidly detect the presence of aflatoxins. The assay has drastically reduced the cost of crop testing, negating the need for extensive laboratory facilities.
**Watershed Management**

Every waterbody (e.g., rivers, lakes, streams, and estuaries) has a watershed. This is the area of land that drains into a specific receiving waterbody, such as a river. Watershed management refers to the process of implementing water and land use practices to both protect and improve the water quality and other natural resources within a watershed through holistic and comprehensive management.

ICRISAT is a global leader in watershed management and promotes an evidence-based, community-driven model in the management of watersheds. The model employs a holistic approach which, in addition to integrated water management, includes soil management, improved crop varieties and production practices, increased on-farm diversity, livestock integration and linking farmers to markets. ICRISAT has been a partner of choice for Corporate Social Responsibility projects on integrated watershed management, and our efforts have received several national awards such as ‘Best Livelihoods Initiative’ ‘Global CSR Excellence & Leadership Award’ ‘National CSR award’ and more.

The ICRISAT Development Center facilitates several watershed projects in India which continue to pioneer unique approaches to watershed management.

**Pest and Disease Management**

**Integrated striga management:** ICRISAT uses a combination of control methods and options – cultural, chemical, biological, physical and the use of resistant crop varieties – to control Striga or witchweed, the main biological constraint to the production of pearl millet and sorghum in West Africa.

**Biological control of millet head miner and fall army worm:** The millet head miner is a major constraint to millet production in the Sahelian zone. The use of the biological control *Habrobracon hebetor*, a minute wasp, is effective against the millet head miner. Augmentative biological control using *Telenomus remus* and Trichogramma provide safe, effective, and socially acceptable option to manage fall army worm.

**Loop-Mediated Isothermal Amplification Method (LAMP):** A fast, visual and user-friendly plant disease diagnosis method that helps quickly identify root pathogens that affects chickpea and can also be used for over 500 other crops globally, including nutritionally and commercially significant crops such as soybean, maize, sunflower, groundnut, pigeonpea, jute, and sorghum.
Climate-Smart Agriculture Technologies

Our climate-smart crops coupled with innovative technologies such as contour bunding, microdosing, intercropping, zai pits, conservation focused agriculture, integrated soil fertility management, crop diversification all work to buffer the risks associated with climate change in agriculture and contributes to food and nutrition security.

Bioreclamation of degraded lands: ICRISAT pioneered a system that converts degraded crusted soils into productive lands by combining indigenous water harvesting technologies (micro-catchments, planting pits and trenches), application of animal and plant residues and planting high-value fruit trees and annual indigenous vegetables that are drought resilient.

Decentralized wastewater treatment system for safe reuse in agriculture: For the bio-treatment of wastewater and reuse of treated wastewater in agriculture, ICRISAT developed field scale constructed wetlands as a model facility.

Microdosing: ICRISAT has led the development of microdosing - the application of small, affordable quantities of inorganic fertilizer applied with the seed at planting or as a top dressing - to enhance fertilizer efficiency. This method was tested and proved effective in Niger and Zimbabwe for those farmers who lacked the means to invest in larger quantities of fertilizer.
ICRISAT has developed leading facilities and services to respond to the knowledge and information needs of our agricultural stakeholders and clients. ICRISAT primarily works with national agricultural research systems, national and international partners, universities, scientific institutions and a range of other bodies to develop and share scientific advances.

**Key facilities and services include:**

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**Center of Excellence on Climate Change Research for Plant Protection**

The center works to understand the effects of climate change variables on the occurrence and distribution of diseases and insect pests with special focus on legumes (chickpea and pigeonpea). The facility is equipped with open top chambers and Free Air CO2 enrichment to study host x pathogen/pest x environment interactions and the resistance to pests and pathogens in resistant and susceptible cultivars.

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**Center of Excellence in Genomics and Systems Biology Facility**

The Center of Excellence in Genomics and Systems Biology is equipped with an Illumina HiSeq 2500 - the world's most powerful sequencer, as well as SSR, DArT and SNP genotyping platforms to provide (a) applied genomics research and sequencing, (b) high quality marker genotyping services and (c) molecular breeding services.

The center is also equipped with a computational genome analysis facility to analyze, store and share huge sequence data. The facility has supported ICRISAT-led global gene sequencing programs for chickpea, pigeonpea and groundnut. The genotyping services, including MiSeq-based next generation sequencing, are provided on a cost recovery basis to all partners and clients from national agricultural research systems, the private sector and the global research community.

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**Genebank**

ICRISAT’s genebank established in 1979 at Patancheru headquarters, India serves as a world repository for the collection of germplasm of 11 crops: sorghum, pearl millet, chickpea, pigeonpea, groundnut, finger millet, foxtail millet, little millet, kodo millet, proso millet and barnyard millet. With 129,415 germplasm accessions assembled from 144 countries through donations and collection missions, it is one of the largest international genebanks.

The genebank conserve several landraces that have disappeared from their natural habitats in Africa and Asia and is acclaimed for repatriating over 55,000 accessions to nine national programs in Asia and Africa. Since its inception, the ICRISAT genebank has supplied 1.565 million seed samples to researchers in 149 countries. The regional genebanks in Niamey (Niger), Bulawayo (Zimbabwe) and Nairobi (Kenya) facilitate easy access to regional and global diversity and act as active distribution hubs for sub-Saharan Africa.
Plant Quarantine Laboratory

The movement of seeds between countries is controlled as per Government of India regulations as well as those of receiving countries. All seeds for research imported by the institute or sent to other countries from headquarters, are tested in the Plant Quarantine Laboratory, and cleared and certified by Government of India officials.

Phenotyping Facility

Phenotyping or measuring key traits of crops such as their ability to withstand drought is crucial to the disciplines of breeding and genetics to speed up the development of improved varieties. ICRISAT has modern phenotyping facilities including the Rainout Shelter, LeasyScan High-Throughput Phenotyping Facility, LysiField High-Throughput Lysimeter Platform and a Facility for Exploratory Research on Nutrition.

The phenotyping area within ICRISAT is also equipped with a leaf area meter, root scanning facility, hydroponics platform, root pressurization facility and more. The lysimeter facility and the LeasyScan facility, ideal for genetic analysis or pre-screening of breeding progenies, are available for use by our research partners as a service. All these facilities combine to generate high-quality phenotypic data.

Platform for Translation Research on Genome Edited Crops

The platform provides a complete solution for the effective development of genome edited products and their delivery. It also serves as a platform to strengthen national, regional and international linkages and collaborations in genome edited research and development, exchange of materials and information, and to support training, consultation and technology commercialization.

The platform features modern facilities for genome edited crop development on an area of 50,000 square feet, comprising a high-throughput transformation facility, molecular biology laboratory, analytical laboratory, plant pathology and virology laboratory, insect-rearing bioassay facilities, biosafety level 2 greenhouses and conventional greenhouses.

Rapid-Gen Advancement Facility

ICRISAT’s Rapid-Gen Advancement Facility comprising testbed optimization chambers, lighting controlled greenhouse bays, and a temperature-regulated light deprivation polyhouse, is a first of its kind. RapidGen significantly reduces the cost and time required for crop breeding which normally takes about six to seven years and can reduce the breeding cycle time by about 40% for most crops.

ICRISAT collaborates with several agricultural research institutes under the Indian Council of Agricultural Research, state agriculture universities and industry partners to mainstream the rapid cycling of crops for which protocols have already been standardized. ICRISAT’s Rapid-Gen protocols for chickpea, groundnut, pearl millet and sorghum have already benefited national breeding projects.
Soil Laboratory

Since 1978, ICRISAT’s soil laboratory has been at the forefront of soil, plant and water analyses for plant breeders, soil scientists, academicians and other agriculture domain experts. The facility was accredited by the FAO Global Soil Laboratory Network (GLOSOLAN) in 2020, becoming only the second lab in India to achieve this distinction.

The laboratory provides cost-effective and quality analytical services for over eighteen soil and plant parameters inclusive of primary, macro, micro-nutrients and heavy metals. It features leading automated equipment such as Inductively coupled plasma optical emission spectroscopy, microwave plasma-atomic emission spectrometer and auto-analyzers. ICRISAT also has a proven track record in setting up referral soil laboratories in different locations and in providing practical training programs for field staff.

Remote Sensing and Geographic Information Systems (GIS)

The ICRISAT Geospatial lab uses remote sensing and GIS-based analysis to inform planning and research priorities. ICRISAT is a partner in ‘Connecting Space to Village’, a joint initiative of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America. The program helps developing countries use satellite data to address critical challenges to food security, water resources, weather and climate, land use and disasters.

Business Incubation Services

ICRISAT recognises that the creative potential of entrepreneurs can positively impact the future of dryland agriculture and those who depend on it for their living. Consistent with its desire to commercialise economically viable innovations and encourage more youth into agriculture, ICRISAT has specialty business incubators across various locations.

Agribusiness and Innovation Platform (AIP)

The AIP was established in 2003 by ICRISAT with support from the Department of Science and Technology, Government of India, under its National Science & Technology Entrepreneurship Development Board. The first agricultural sector focused incubator, AIP is recognized as a ‘Technology Business Incubator’ that promotes agri-based entrepreneurship in the drylands while facilitating public-private partnerships for growth. The AIP provides prototype innovation, knowledge and expertise, training and commercialization of prototypes.
ICRISAT Capability Statement 2022

Systems Strengthening

ICRISAT works to strengthen the systems of national agricultural research institutes and other organizations such as providers of extension advisory services, cooperatives, farmer organizations and the private sector in the diverse value chains and webs in which we specialize. Some examples include the capacity development of institutional systems such the early generation seed management program in Mozambique, and extending the Hybrid Parents Research Consortium to Eastern and Southern Africa. ICRISAT also organizes short-term training courses, workshops and field days for knowledge sharing and learning.

Training Courses

The Institute conducts specialized practical skill and general training courses on new cutting-edge technologies, research methodologies and other emerging topics from time to time. By gaining these skills, national partners are better able to contribute to our shared research for development agenda. Announcements of these courses are shared with national institutions, allowing them ample time to participate.

Student Opportunities and Internships

ICRISAT’s Learning Systems Unit facilitates the placement of scholars, partners and students in various research programs and projects across all locations and laboratories of the Institute. The Unit facilitates studies and joint project attachments. ICRISAT is proud of its record of mentoring over 1700 MSc and PhD students for their thesis research work at ICRISAT locations in Asia and Africa. In addition, we have provided opportunities to many students and scientists from national programs to spend three to six months as interns or visiting scientists.
All of ICRISAT’s work and research impacts are crosscutting and draw from the experience and local context of our regional offices.

**Regional impacts**

ICRISAT-bred improved lines and germplasm are widely shared with partners globally. As of 2022, partners in 81 countries released 1224 varieties using these materials.

<table>
<thead>
<tr>
<th>Region</th>
<th>Varieties released using ICRISAT-supplied germplasm and breeding material</th>
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<tbody>
<tr>
<td>Algeria</td>
<td>Sorghum</td>
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<td>Australia</td>
<td>Chickpea</td>
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<td>Bangladesh</td>
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<td>Botswana</td>
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<td>Burkina Faso</td>
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<td>Zambia</td>
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<td>Zimbabwe</td>
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</tbody>
</table>

Legend:

- Asia
- Eastern and Southern Africa
- West and Central Africa

Varieties released using ICRISAT-supplied germplasm and breeding material:

- Sorghum
- Chickpea
- Groundnut
- Pigeonpea
- Finger millet
The challenges facing the drylands are large and complex with sustainable solutions beyond the competence of any one organization. Therefore, partnerships are central to our research for development approach. ICRISAT works with its partners in an interdisciplinary manner from planning through to the execution and evaluation stages of joint activities. Our range of partners include but are not limited to academic institutions, CGIAR centers, foundations, governments and their departments (national/state/local), international NGOs, civil society organizations, national agricultural research system, private industries, seed companies, women’s groups and farmer organizations.
Combine ideas to innovate. Create an innovation together or partner on our existing research work. Partner by using our research facilities and services.

ICRISAT works closely with a variety of companies to help achieve their Corporate Social Responsibility (CSR) objectives. This ranges from rural development and women’s empowerment to becoming water and carbon neutral.

Partner in large-scale adoption of our scientifically proven and piloted solutions to agricultural development.

Food processors and entrepreneurs needing advice or facilities, or those keen to support agribusiness.

**Global Partner Sample**

<table>
<thead>
<tr>
<th>Research Partner</th>
<th>Government of India</th>
<th>CGIAR Centers</th>
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</thead>
<tbody>
<tr>
<td>Acharya N. G. Ranga Agricultural University</td>
<td>Institute d’Economie Rurale (IER)</td>
<td>International Institute of Tropical Agriculture (IITA)</td>
</tr>
<tr>
<td>Asian Development Bank (ADB)</td>
<td>Institut Sénégalais de Recherches Agricoles (ISRA)</td>
<td>International Livestock Research Institute (ILRI)</td>
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<tr>
<td>African Development Bank (AfDB)</td>
<td>Leibniz Institute of Agricultural Development in Transition Economies (IAMO)</td>
<td>The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT)</td>
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<tr>
<td>AGRHYMET</td>
<td>McKnight Foundation</td>
<td>World Agroforestry (ICRAF)</td>
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<tr>
<td>Australian Centre for International Agricultural Research (ACIAR)</td>
<td>Natural Sciences and Engineering Research Council of Canada</td>
<td>International Potato Center (CIP)</td>
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<td>AFRI Coalition</td>
<td>Tata-Cornell Institute</td>
<td>International Water Management Institute (IWMI)</td>
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<td>Alliance for a Green Revolution in Africa (AGRA)</td>
<td>US Department of Agriculture</td>
<td>International Food Policy Research Institute (IFPRI)</td>
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<tr>
<td>Australian Centre for International Agricultural Research (ACIAR)</td>
<td>University of Nottingham</td>
<td>International Center For Agricultural Research in the Dry Areas (ICARDA)</td>
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<tr>
<td>BiOWiSH Technologies International, Inc.</td>
<td>United States Agency for International Development (USAID)</td>
<td>International Maize and Wheat Improvement Center (CIMMYT)</td>
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<tr>
<td>Centre for Dryland Agriculture, Bayero University</td>
<td>United Nations World Food Programme (WFP)</td>
<td>World Fish</td>
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<tr>
<td>Catholic Relief Service (CRS)</td>
<td>US Department of Agriculture</td>
<td>Center for International Forestry Research (CIFOR)</td>
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<tr>
<td>CARE International</td>
<td>Wm. Wrigley Jr. Co</td>
<td>International Livestock Research Institute (ILRI)</td>
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<tr>
<td>Food and Agriculture Organization of the United Nations (FAO)</td>
<td>Welthungerhilfe</td>
<td>Africa Rice</td>
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<tr>
<td>Global Crop Diversity Trust</td>
<td>United Nations World Food Programme (WFP)</td>
<td>Welthungerhilfe</td>
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<td>Hawassa University</td>
<td>Wellcome Trust</td>
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<td></td>
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<tr>
<td>Partner Together</td>
<td>Agribusiness</td>
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<tr>
<td>Corporate Social Responsibility</td>
<td>Large-Scale Adoption</td>
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<tr>
<td>Research</td>
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</tbody>
</table>

ICRISAT Capability Statement 2022
Leadership Team

Jacqueline d’Arros Hughes  
Director General

Sanjay Agarwal  
Assistant Director General

Arvind Kumar  
Deputy Director General - Research

Angshu Sengupta  
Deputy Director General - Corporate Services

Kunal Sarkar  
Director - Human Resources

Ramon Peachey  
Director - Communications

Stefan de Greling  
Director - Business Development
Awards

ICRISAT has been the recipient of several global accolades in recognition of its impacts in reducing poverty, hunger, malnutrition and environmental degradation.

Africa Food Prize
2021

CGIAR King Baudouin Awards
1996
1998
2002
2004

CGIAR Science Awards for Outstanding Partnerships
2006
2010

Dr Ramadjita Tabo: Nobel Peace Prize as part of the Intergovernmental Panel on Climate Change
2007
Prime Minister Narendra Modi inaugurates ICRISAT 50th Anniversary Celebrations, 5 Feb 2022

Special Visitors

**Indira Gandhi**  
11 Jan 1975

**Queen Elizabeth II**  
30 Jan 1983

**PV Narasimha Rao**  
29 Aug 1992

**APJ Abdul Kalam**  
20 Jun 2013

**Bill Gates**  
30 May 2013
ICRISAT is proud to be celebrating its 50th anniversary in 2022, which was inaugurated in early February by the Hon. Prime Minister of India, Shri Narendra Modi. The Institute’s illustrious history has been one defined by scientific research and partnerships which have delivered numerous world firsts in reforming dryland agri-food systems. These breakthroughs are among the most tangible impacts of all development interventions in overcoming poverty, hunger, malnutrition and environmental degradation for many of the 2.1 billion who call the drylands of Asia, Africa and beyond home. The awarding of the Africa Food Prize 2021 to ICRISAT is a testament to our impacts and contributions to the Sustainable Development Goals. The challenges facing the drylands are inextricably linked so our focus lies not only within the domain of agricultural science, technology and innovation but the social, institutional and structural requirements of smallholder dryland farming. Our work also has a nation building imperative. From playing a passive role in economic development, the agricultural sector and the rural economy must now have a strong and dynamic role in the overall economic development strategy of developing nations. As a global knowledge leader, ICRISAT looks to the next 50 years with confidence that a brighter future can be created for the myriad of dryland communities whom we serve. We invite you to partner with us on this journey.

ICRISAT’s unique expertise in the management of dryland ecosystems and genetic improvement of nutritious grain legumes and dryland cereals that tolerate the vagaries of climate change, make it an essential partner for research and development to achieve the SDG targets. ICRISAT’s expertise spans traditional concerns such as malnutrition and rural poverty to emerging concerns such as diet transition and climate resilience. ICRISAT’s reimagined strategy elevates its work and positions its science, talent, partnerships and resources in order to maximize impact on the sustainable utilization of dryland ecosystems and the poor that depend on them. As we celebrate our 50th Anniversary we extend to you an cordial invitation to join our mission.
The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a pioneering, international non-profit scientific research for development organization, specializing in improving dryland farming and agri-food systems. The Institute was established as an international organization in 1972, by a Memorandum of Agreement between the Consultative Group on International Agricultural Research and the Government of India. ICRISAT works with global partners to develop innovative science-backed solutions to overcoming hunger, malnutrition, poverty, and environmental degradation on behalf of the 2.1 billion people who reside in the drylands of Asia, sub-Saharan Africa, and beyond.

www.icrisat.org