



Annual Report
2022

Commemorating 50 years of Impact



Message from the Director General

We begin the year 2022 with great enthusiasm, having been honored with the prestigious Africa Food Prize 2021. This recognition has further strengthened our commitment to advancing agriculture and food security in the dryland tropics, and we are pleased to present to you ICRISAT's annual report for this year, which is particularly significant as it marks the Institute's 50th anniversary.

This milestone was commemorated by the Prime Minister of India, Narendra Modi, who recognized our deep contributions made to dryland agriculture and food security not only in India, but in Africa and further afield. We are immensely proud of this recognition by a global leader of his stature, and take great pride in the many partnerships that have enabled this success. It underscores the impact and relevance of our work in supporting robust agri-food systems in the drylands to improve the lives and livelihoods of small-holder farmers and their communities.

Our organization's Strategic Plan continues to guide our efforts towards achieving our vision of a prosperous, food-secure, and resilient dryland tropics. Our three global research programs and three regional programs work seamlessly across our regions and together they continue to make a significant impact on the lives and livelihoods of smallholder farmers in Africa, India, and beyond, particularly in the areas of crop improvement, natural resource management, and market-oriented development. These practical contributions to the Sustainable Development Goals (SDGs) are particularly noteworthy, and we are proud to be contributing to these important global targets.

As we look ahead to the year 2023, we are preparing for the UN International Year of Millets, which will be an important platform for promoting the nutritional and economic benefits of these often-overlooked crops. At ICRISAT, we have long recognized the importance of millets in supporting the livelihoods of dryland smallholder farmers and their role in improving food and nutrition security. Our research in this area has yielded important insights and innovations that will be highlighted during this global event.

As you peruse this report, we hope you will be inspired by the scope and depth of the Institute's achievements over the past year. We are grateful for the support of our donors, partners and other stakeholders, and we look forward to continuing to work together towards a brighter future for the world's drylands.



Dr Jacqueline Hughes Director General

Message from the Governing Board Chair

As the Governing Board Chair of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), I am delighted to celebrate the 50th anniversary of our esteemed institution. It was an immense honor to have the distinguished presence of the Prime Minister of India, Narendra Modi join us in commemorating this special occasion. His recognition of ICRISAT's contributions to agricultural research and innovation in the semi-arid tropics is a testament to the institute's ongoing impact and dedication to improving the lives and livelihoods of smallholder farmers in the global drylands.

Our 50th anniversary not only provides us with an opportunity to reflect on our past achievements, but it also inspires us to set our sights on the future as a global leader in agricultural research and innovation in the dryland tropics. Building upon our rich legacy of innovation, we are determined to remain at the forefront of scientific advancements and technology, while fostering collaborations and partnerships to maximize our impact and reach.

As we enter a new era of global challenges, we recognize the importance of repositioning ourselves to have an even greater impact on the lives and livelihoods of smallholder farmers in Africa, Asia, and beyond. Our focus on collaborative and productive partnerships, along with cutting-edge research, is key to this endeavor. Through our collaborations with governments, private sector organizations, and other research institutions, we are strengthening our efforts to achieve our shared goals.

Our achievements are a testament to the creativity and hard work of our researchers, staff and valued partners. As we look to the next 50 years, we remain committed to building upon our legacy and finding new and innovative ways to improve the lives of those we serve.

Finally, I would like to express my sincere gratitude to my fellow board members, partners, donors, leadership team, and staff for their unwavering support of ICRISAT's mission. I trust this report will provide a brief insight into our collective impact and how together, we can continue to serve the many smallholder farmers and their communities who rely on us for a brighter future.



Professor Prabhu Pingali Governing Board Chair





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ICRISAT thanks its donors, partners and supporters for enabling us to keep delivering the innovations that overcome hunger, malnutrition, poverty and environmental degradation for the 2.1 billion people who reside in the drylands of Asia, sub-Saharan Africa and beyond.

Local Reach, Global Impact

Research Highlights



Twenty two new cultivars of sorghum (13), pearl millet (3), chickpea (5), and groundnut (1) released in South Sudan, Tanzania, Zimbabwe, and India using ICRISAT germplasm



About **38,300** seed samples distributed to researchers globally and **50,000** accessions safety duplicated at IITA, World Vegetable Center, and USDA-ARS genebanks



Transforming Irrigation systems in Southern Africa (TISA) project, led by ICRISAT and partners, wins the **2022 EFMD Excellence in Practice Gold Award**



ICRISAT recognized as a knowledge partner by the National Rainfed Area Authority for developing National Technical Standards for integrating Land Resource Inventory and hydrology for new generation watershed management programs

ICRISAT signs a **five-year cooperative agreement** with USAID for implementing the second phase of **SERVIR West Africa**



ICRISAT partners with **World Food Program and Institute** of Rural Economy in Mali to test and validate new recipes on millets and legumes and popularizes them through community awareness and capacity building programs



A secondary processing unit and a millet processing unit set up in Andhra Pradesh and in Odisha, India, respectively, for the benefit of farmers



Launch of MRIDA, a gaming app for farmers that facilitates behavioral change for adopting climate-smart agriculture practices, developed in collaboration with Vasudhaika Software Private Limited (Kalgudi)



Eighty participatory validation trials held in the State of **Telangana, India**, under the 'Groundnut Value Chain Innovations to Enhance Farmer Profitability and Promote Oil, Food and Confectionery Industries in Telangana' project



Over 100 participatory validation plots in Senegal feature early-maturing pearl millet, groundnut, and cowpea varieties that are high-yielding and pest-resistant with high biomass under the AICCRA project, funded by the World Bank and led by ILRI in collaboration with ICRISAT and CIAT.

New varieties released in 2022



Selected new projects (2022)

India

Building Community Resilience by Alleviation of Water Scarcity and Land Degradation through Integrated Natural Resource Management in Bundelkhand, UP

Increasing Pulses Productivity and Incomes through Science-led Interventions in Rice Fallows of Odisha

Implementation of Frontline Demonstration on Oilseeds and other related activities by ICAR-IIOR during 2022-23 - Sunflower - in the states of Odisha, Chhattisgarh, Jharkhand and Haryana

Pan-Africa

Technologies for African Agricultural Transformation Phase II

Eastern and Southern Africa (ESA)

Scaling Commercialization of Drought Tolerant Crops (DTC) technologies to Enhance COVID 19 Recovery and Resilience and Secure Dignified and Fulfilling Work for Youth

(Kenya)

Takunda program

(Zimbabwe)

Strengthening agri-food systems in Niassa to unlock livelihoods and economic opportunity (Mozambique)

Aflatoxin Prevention and Control along the Groundnut Value Chain

(Malawi)

Harnessing crop (finger millet) diversity to mitigate the effects of our changing climate

(Kenya, Tanzania and Uganda)

China

West and Central Africa (WCA)

Pearl millet and sorghum seed kits for boosting productivity and strengthening resilience of vulnerable households

(Niger and Chad)

Enhancing the productivity and resilience of agro-pastoral systems, and income, food and nutrition security through market-oriented innovations

(Niger)

Sorghum variety development and improvement (Nigeria)

Networking4Seed II (Burkina Faso, Niger, Mali)

Gendered analysis of farm household level climate risk perceptions, coping strategies, access to climate information and household resilience in dry regions (Senegal)

SERVIR West Africa

(Burkina Faso, Ghana, Mali, Niger, Nigeria and Senegal)

Others

Australia

Establishment of CAAS-ICRISAT-ICARDA Joint Centre of Excellence for Dry Land Agriculture (China)

Chickpea Commercialization (Australia)



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Corporate



ICRISAT Governing Board Members



Governing Board Chair



Himanshu Pathak Governing Board Vice Chair Ex-officio, Government of India



Manoj Ahuja Ex-officio Government of India



Jacqueline Hughes Director General Ex-officio



Somesh Kumar Ex-officio Government of Telangana, India



Yaye Kene Gassama Independent



Yilma Kebede Independent



Independent



Laurie Tollefson Independent



Independent



Regine Andersen Independent (from March 2022)



Independent



Sissel Rogne Independent (until March 2022)

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Human Resources



In 2022, ICRISAT consolidated its position as a globally diverse organization, with a workforce of **over 2100 members** from **26 different nations**, actively **working across 14 countries**. As part of its commitment to providing a supportive and engaging workplace environment, the Institute conducted an independent staff survey to gauge employee satisfaction and engagement levels across all locations in Asia and Africa.

The survey results were overwhelmingly positive, with employees expressing a strong belief in the mission of ICRISAT and a high level of engagement in their work. The Institute's ongoing efforts to foster a culture of diversity and inclusion have also been well-received by staff members, who report feeling supported and fulfilled in their roles.

As we continue to pursue our mission of improving the livelihoods of smallholder farmers across the drylands, ICRISAT remains committed to maintaining a highly engaged and motivated workforce. We will continue to prioritize the creation of a positive and inclusive work environment, with a strong focus on gender equality and where every member of our team feels valued and supported.

Communications

In 2022, ICRISAT undertook a significant overhaul of its communications program, taking steps to strengthen our connections with our audiences and stakeholders. We've revamped our approach to messaging, ensuring that our communications are more impactful and resonate more deeply with our community.

This approach has included the development of an audience survey to inform a new institutional communications strategy, new policy and procedures, the development of marketing collateral, the introduction of two industry-leading media platforms, an online pressroom and a new external and internal e-newsletter. The planning of a new ICRISAT website also commenced, which will be launched in the first half of 2023.

Throughout the year, we made significant strides in our media outreach, successfully connecting with a diverse and widespread audience. We shared 136 multi-media articles and opinion pieces with mainstream and specialised media outlets, helping to result in over 5,000 mentions across various global, regional, and local outlets in ten different countries. Our work has been featured in media organisations with over 400 million monthly readers/ viewers, greatly expanding our reach and amplifying awareness of our mission. Our social and other media reached more than 200,000 followers across various channels and continues to grow. We received over 11,000 visitors, of which 80% were students and other visitors included farmers, scientists, diplomats and high-level delegations from international organizations.

Key outputs include

B	New policies and procedures
The state	New marketing collateral
@_{{}} {} 0-@	New industry-leading media platforms
	New online pressroom
NEHS	New e-newsletters

Planning of a new ICRISAT website



Donors and Partners

Partnerships (2022)

Academic Institutes	05
Governments	13
NGOs	21
Private Industries	04

Top Donors for 2022

The World Bank via International Center for Tropical Agriculture (CIAT)

Government of India

Government of Odisha

USAID

African Development Bank via International Institute of Tropical Agriculture (IITA)

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany

Walmart Foundation, USA





Research Outcomes



Message from the Deputy Director General - Research

Drylands are home to over 2 billion people worldwide. The challenges posed by environmental, economic, and social factors present an opportunity to deliver more innovative and sustainable solutions for this sector. Our interdisciplinary collaboration and context-specific approaches to advancing sustainable dryland agriculture, draw on the latest research and best practices from around the world and which are demonstrated in the seamless collaboration between our research and regional programs across Asia and Africa.

During 2022, ICRISAT was instrumental in releasing 22 new cultivars of sorghum, pearl millet, chickpea, and groundnut in South Sudan, Tanzania, Zimbabwe, and India. These cultivars are designed to be resilient, productive, and high in nutrients.

ICRISAT made significant contributions to the ACIARfunded TISA Project, which successfully transformed inefficient subsistence farming into market-oriented production systems across 13 small-scale communal irrigation schemes in Zimbabwe. The project increased irrigation water productivity and profitability, benefiting 1698 farmers and covering 757 hectares. The project also helped farmers cope better with the COVID-19 pandemic, highlighting the adaptive capacity that may be transferable to perturbations arising from climate change. Our improved groundnut varieties have had a significant impact on farmers in Ghana, Mali, and Nigeria, resulting in improved yields and household income. The establishment of a Secondary Processing Unit in Anantapur, Andhra Pradesh, India, is expected to benefit around 6,000 farmers by producing highly nutritious millet- and pulse-based RTE and RTC products.

These impacts are elaborated in the following pages which are a testament to the unwavering commitment of our scientists, partners and others in enhancing the resilience and productivity of smallholder farmers. Their tireless efforts in developing and promoting climatesmart agriculture, drought-tolerant crops, and innovative agricultural technologies have ensured food and nutrition security and profound improvements to the quality of life for millions of people living in the drylands of Asia, Africa and beyond. Lastly, these impacts would not have occurred without the generous support of our valued donors. On behalf of all those who call the drylands home, we express our heartfelt gratitude to you.



Dr Arvind Kumar Deputy Director General – Research

Global and Regional Program Directors



Innovating for Impact: Accelerating Crop Nutrition and Productivity

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ICRISAT through the Accelerated Crop Improvement Program leads the development of improved crop varieties for Africa, Asia, and beyond. The Program employs advanced technologies and innovative approaches to develop improved crop varieties with desirable traits such as increased yield, better nutritional quality, and enhanced resilience to biotic and abiotic stresses. These involve the use of various tools such as genomics-assisted selection, gene editing, phenomics, and speed breeding to accelerate the breeding process and reduce the time required to develop new crop varieties. Once varieties are developed, our seed systems research makes them available to farmers to use in their fields.

1.1: Improved Varieties

The past year has seen great progress and achievement for the Program, as it continued its vital work in developing climate-resilient crop varieties that can help farmers adapt to the challenges of a changing climate.

One of the key highlights of the year was the release of **22** new cultivars:





Sorghum plant showing damage caused by FAW

These new cultivars are the result of years of dedicated research and development and are designed to be more resilient and productive than previous varieties while maintaining high levels of nutrients.

To ensure that the development of climate-resilient crop varieties is sustained, the Program conducted **313 stage-I** multi-environment tests (MET) using **over 14,000 new unique breeding** lines of sorghum, pearl millet, finger millet, pigeonpea, chickpea, and groundnut, in **over 85,000 experimental plots**. These METs were coupled with field days that saw the participation of **more than 250 stakeholders** from public and private institutions across Africa, Asia, and South America.

Thanks to this intensive testing and evaluation process, several promising resilient varieties were identified, including groundnut genotypes with improved resistance to Groundnut Rosette Disease (GRD), Late Leaf Spot (LLS), and rust; pigeonpea genotypes with resistance to Fusarium Wilt (FW) and Sterility Mosaic Disease (SMD); sorghum genotypes with multiple pest resistance (Fall armyworm, shoot fly, sugar cane aphid); and pearl millet genotypes with resistance to Downy Mildew (DM) and blast disease.

In addition to these key achievements, the Program also conducted additional screening for enhanced resilience in several crops, including chickpea, pearl millet, and sorghum. Using accessions from the Genebank, the Program conducted screening for heat tolerance and disease resistance in chickpea; for *Striga hermonthica* resistance in pearl millet in Sadorè, Niger; and for the Biological Nitrification Inhibition (BNI) trait in sorghum. The BNI trait is particularly important as it can enhance nitrogen uptake while reducing both underground water contamination and greenhouse gas emissions, making it a key resilience trait that is highly relevant in the semiarid tropics (SATs) which can also be coupled with other agronomic approaches, such as microdosing of fertilisers.

1.2: Enhancing Crop Productivity and Nutritional Value

ICRISAT's commitment to improving the nutritional value of crops for farmers in the semi-arid tropics has led to impressive breakthroughs. Through the evaluation of both cultivated and wild relatives of mandate crops, the Program has identified high protein content in wild species of sorghum and pearl millet. Additionally, a study on pigeonpea unveiled that the outer seed coat boasts a remarkable abundance of **652 mg of calcium** per **100 g** of pigeonpea.

In chickpea, the identification of a gene, CaTIFY4b, that regulates seed weight and organ size, has paved the way for significant advancements in crop improvement. ICRISAT has also released the GG 40 (ICGV 16668) cultivar of groundnut, which boasts high oleic acid content for longer shelf life and improved health benefits. Additionally, ICRISAT has achieved the stacking of brown mid-rib genes in sorghum, resulting in fodder that is more digestible for animal feed due to a reduction in lignin content. These accomplishments represent significant strides towards enhancing crop productivity and nutritional value in the semi-arid tropics.





1.3: Germplasm Collection and Conservation

ICRISAT's germplasm collections continue to serve as an invaluable reservoir for present and future breeding programs, and we are proud to report that they have been further enriched over the past year.

Our efforts to expand these collections have resulted in the total acquisition of

including from the Niamey regional genebank in Niger, community seedbanks in Zimbabwe, and from the Australian Grain Genebank (AGG).

The impact of our genebanks extends far beyond ICRISAT, as we distributed

seed samples to researchers worldwide in 2022.

Additionally, we successfully undertook an immense safekeeping exercise, resulting in the safety duplication of **50,000 accessions** across various genebanks, including the International Institute of Tropical Agriculture (IITA), the World Vegetable Center, and the United States Department of Agriculture - Agricultural Research Service (USDA-ARS) genebanks, further ensuring the long-term preservation of these vital genetic resources.

Our work has garnered the attention of the private sector who have expressed a keen interest in partnering with ICRISAT. This has led to the addition of new members to the varieties consortia, including the Hybrid Parents Research Consortium (HPRC), which speaks to the impact and relevance of our research initiatives. As we look to the future, we remain committed to advancing our germplasm collections and fostering valuable partnerships that will contribute to the sustainable growth of dryland agriculture.

2. Growing Resilience: Future-Proofing Farming

The Resilient Farm and Food Systems Program works seamlessly across Asia and Africa to develop and scale resilient agri-food systems designed to withstand and recover from disruptions caused by various stressors such as environmental degradation, climate change, pests, and drought. The Program emphasizes the importance of building strong and adaptable agricultural systems that can withstand these stressors and prioritize strategies and practices such as regenerative and low carbon landscapes, soil and water conservation, diversified farming systems including agroforestry that improve soil health, economic and nutritional water productivity, and conserve biodiversity while reducing greenhouse gas emissions, increasing productivity and farm income. The program employs geospatial & big data science and digital tools for building the resilience of dryland agri-food systems. Importantly, these systems emphasize local contexts and ownership.

2.1: Growing Resilience in Africa

Transforming Agricultural Practices in Eastern and Southern Africa: The Case of Zimbabwe's Shift from Inefficient Subsistence Farming to Market-Oriented Production

ICRISAT continues to support farmers in Southern and Eastern Africa transition from subsistence to small-scale commercial farming which is delivering:

- increased productivity and income through the sale of surplus produce, thereby improving food security and livelihoods;
- market-oriented production systems that help farmers to access better markets in which to earn higher prices for their produce. This leads to increased income and improved living standards for farming communities; and
- greater economic growth in rural areas, creating employment opportunities and reducing rural-urban migration. This is helping to promote sustainable development and reduce poverty.

ICRISAT has been part of the groundbreaking project 'Transforming Smallholder Irrigation into Profitable and Self-Sustaining Systems through outscaling in Southern Africa (TISA) Project, funded by the Australian Center for International Agricultural Research (ACIAR). The project, with the crucial contribution of ICRISAT, has achieved remarkable progress in shifting small-scale communal irrigation schemes that have traditionally supported inefficient subsistence farming to market-oriented production systems. The project uses a two-pronged approach of Smart Water Management (SWM) tools

(the Chameleon and Full Stop Wetting Front Detector) and Agricultural Innovation Platforms (AIPs) to increase irrigation water productivity and profitability across various smallholder irrigation schemes.

The project successfully reached 1,698 farmers, covering 757 hectares in 13 small-scale communal irrigation schemes in Zimbabwe. The use of SWM tools resulted in reduced over-irrigation and increased nutrient retention, resulting in improved water productivity from 0.2kg of maize per m³ of water in 2013/14 to 1.2 and 0.98 kg/ m³ in 2016/17 and in 2020/21, respectively. A survey conducted in 2022 to evaluate how the COVID-19 pandemic impacted farmers, comparing project schemes to non-project schemes in terms of food and nutrition security, farm income, children's access to education and many other key indicators showed that the COVID-19 pandemic impacted both TISA and non-TISA schemes, but the magnitude of the impact differed, being lower in TISA schemes. This implies that TISA interventions helped farmers cope better with the shock that COVID-19 pandemic caused, and this adaptive capacity may be transferable to perturbations arising from climate change.

The TISA project acknowledges that irrigation systems are complex and face various constraints, and an integrated system approach is needed to shift them towards marketoriented production. The project has found effective ways to initiate change within the irrigation schemes and engage with higher political levels to support the systemic shift.

The AIPs have performed a critical role in facilitating experimental learning from using the tools, stimulating learning around gross margins, integrating the private sector, establishing links between farmers and input and output markets, and facilitating information flows.

The TISA project received the highly acclaimed 2022 European Foundation for Management Development EFMD Excellence in Practice Gold Award

for its remarkable achievements in transitioning small-scale communal irrigation schemes to marketoriented production systems, leading to a significant improvement in the livelihoods of numerous smallholder farmers.

Building Resilient Agri-Food Systems in Drylands of Africa: Lessons from Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)

The past year has seen significant progress towards transforming agri-food systems in the drylands to be more resilient to the challenges posed by climate variability and change. The Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) project has been a key driver of this progress, with its efforts focused on strengthening the capacity of targeted partners and stakeholders to access climate information services (CIS) and validated climate-smart agriculture (CSA) technologies.

In Zambia, Kenya and Senegal, the AICCRA project has developed and deployed an AgDataHub prototype (AICCRA Dashboard) and training manuals on crop varieties choices and associated CSA packages. The AgDataHub has been instrumental in bridging the gap between meteorological services and agricultural extension systems, facilitating the dissemination of CSA and CIS to farmers.

Pilot programs have been implemented in three agroecological zones in Senegal to evaluate crop response to variable climate risks and farm management practices.

In total,

108 participatory validation plots

have been established in

18 villages

combining

pearl millet and **groundnut** cultivars using the integrated soil fertility management approach.

In **Kenya** and **Zambia**, more than

50 participatory learning sites

on CSA packages and practices have been piloted, with

1,500 farmers in Kenya

receiving small packs of seed of droughttolerant crops with a plan to distribute it to

15,000 more farmers in the next season.

Efforts have also been focused on enhancing the capacity to form innovative partnerships for sustained delivery of climate services. This has included training of trainers to facilitate the dissemination of CSA and CIS, as well as facilitating a training course on climate risk management for systems agronomists in collaboration with partners from Germany.

ICRISAT is utilising the Intelligent Systems Advisory Tool (iSAT) to give farmers advice each week that takes into account climate and market conditions. The tool also suggests technological solutions to help farmers improve their crops.

In terms of climate information services, the AICCRA project has sent through

to 2,720 registered farmers

23.5% of the recipients were women In Kenya, **20,000 farmers** are now accessing weather-informed advisories via SourceTrace, while in Zambia, radio and TV broadcasts have **reached thousands of beneficiaries** through the Shamba Shape Up Munda Makeover programme and the COMACO – Federation bundle which has **reached out to 3500 beneficiaries**.

Overall, the AICCRA project has made significant strides in advancing the transformation of agri-food systems in these target countries, leading towards a more sustainable future. Through its efforts, it has strengthened the resilience of farmers to the multiple stresses and challenges faced in the region, ensuring that agri-food systems can continue to provide food security for growing populations.

2.2: Digital Agriculture

ICRISAT, along with its strategic partners, has a mission to showcase the creation of inclusive value in the agriculture sector through digitalization and innovation. One of the successful initiatives is Plantix, the largest agri digital ecosystem in India that has digitalized a network of over 60,000 retail outlets for plant protection products. The app has reached 1.2 million monthly users globally and has been used to detect 600 pests and diseases on 35 crops in 18 languages with 95.2% accuracy. ICRISAT has also launched new decision support apps such as MRIDA, to guide fertilization, crop, biochar, and irrigation decisions, and supported algorithmic and app development for monitoring disease and invasive species from drones, IoT, and satellite data.

Apart from digitalization, ICRISAT is also working on predicting the behavior of rural populations through the HEURISTICS project. This project uses AI and computational methods to model, simulate, assess, and enhance the resilience of agricultural value chains. HEURISTICS has been successful in predicting rice planted areas in Senegal with only 2% error, two months ahead of the current gold standard, and has been approved to scale to Ghana and Uganda to predict the expansion of illegal mining.

ICRISAT collaborates with private partners to ensure that research outputs are integrated into service platforms that can monetize and grow solutions. For instance, agCelerant encapsulates the concept of "phygital agriculture," which combines physical asset management with digital solutions to ensure trust and scalability of service. In 2022, agCelerant was the first AgTech selected by IFC to help structure the deployment of a USD 250 million smallholder guarantee fund.

ICRISAT aims to achieve inclusive value creation in digital agriculture by industrializing services, establishing partner ecosystems, and promoting innovation in systems intelligence through disruptive concepts and joint ventures.

2.3: Growing Resilience in India

Revitalizing Indian Landscapes: The Power of an Integrated Approach

ICRISAT recognizes the importance of an integrated landscape approach to support farmers and their communities. This approach considers the interactions between different sectors, land uses, and stakeholders to achieve multiple objectives, such as improving food security, biodiversity conservation, water management, climate change adaptation, and poverty reduction. By adopting this approach, we have been able to address various challenges such as land degradation, water scarcity, poor agricultural and livestock productivity while minimizing greenhouse gases emissions. In addition, it has also provided an opportunity for regenerating fragile farming systems into profitable ones.

Implementation

Our integrated landscape resource conservation approach has been adopted in **13 policy innovation clusters** across different agroecological regions, particularly in the Indian States of Uttar Pradesh and Odisha. This success has been built upon the Land Resource Inventory (LRI) and Hydrology-Based Landscape Management approaches, which has benefited **more than 25,000 households** covering **40,000 hectares** across both States.

As a result, ICRISAT has been recognized as the knowledge partner by the National Rainfed Area Authority for developing National Technical Standards for integrating LRI and hydrology for new generation watershed management programs.

Impact

Our landscape restoration interventions have helped to harvest surface water runoff of about **6.0 million** cubic meters per year, enhancing groundwater availability by 50-150%, base flow by 30-50%, and reducing soil loss by 70-80% compared to the baseline situation.

Using a science evidence-based approach, we successfully revitalized **2,700 acres** of degraded fallow land restoring it to productive cultivation, which has enhanced land and water use efficiency in Uttar Pradesh and Odisha. This has led to increased cropping intensity **from 110% to 180%**. Landform management, such as field bunding and laser land levelling, has contributed to enhancing soil moisture availability by 50-80 mm per season and has reduced the need for irrigation. Integration of landscape and field scale interventions have enhanced crop productivity by 20-80% in different cropping systems.

Furthermore, the landscape restoration and field scale interventions have contributed to enhancing income from agriculture by 40-140% compared to the baseline. The integrated landscape approach has brought about a significant positive impact on agricultural productivity and the livelihoods of tribal families and vulnerable farmers. In addition, it has effectively countered rural-urban migration by inspiring these communities to return to their villages, where they can now sustainably earn a decent living.

Beyond landscape conservation

ICRISAT's effort towards rural development go beyond landscape resource conservation. Through our integrated approach, we are also dedicated to enhancing rural livelihoods by adding value, building capacity, and fostering micro-entrepreneurship. Our work in Koraput district, Odisha, includes establishing a millet processing unit to enhance nutritional security. Furthermore, we have expanded climate-resilient agriculture technologies within landscapes through sustainable intensification of rice fallows using pulses with regenerative agriculture practices to help vulnerable smallholder farmers.

3. Breaking Barriers: Building Effective Agri-Food Systems

The Enabling Systems Transformation program works across all ICRISAT locations and with various dryland agricultural stakeholders to create a more supportive environment for the adoption of context specific, sustainable, and resilient agricultural practices that can withstand future challenges. This is achieved through a combination of policy reforms, institutional changes, technological and nutritional innovations, social engagement and the capacity strengthening of key actors.

3.1: Building Effective Agri-food Systems in Africa

• Adoption and impact studies in the semi-arid areas of Ghana, Mali and Nigeria have led to farmers utilising improved groundnut varieties bred with ICRISAT parental lines. This has led to:

food value chains in Northern Nigeria identified two important action points: (a) infrastructure and regulatory interventions and specific training in agricultural practices are needed to engage youth, and (b) special training programs on food processing targeting the use of modern processing methods should be instituted for female youth who predominantly use the traditional methods.

A gender analysis of youth involvement in agri-

- Studies on trait prioritization and consumer willingness to pay for improved varieties of sorghum and groundnut in Tanzania were conducted to support the development of market-driven and farmerpreferred crop improvement plans. High yield, quality grain, and drought resistance were identified as preferred traits, and farmer trait preferences display strong heterogeneity between consumption-oriented and market-oriented traits.
- DNA fingerprinting studies are ongoing to accurately trace adoption and conduct welfare impact assessments of millet and sorghum technologies in Ethiopia and Tanzania.
- An analysis was conducted showing that chickpea yields in Ethiopia could potentially double by enhancing the technical efficiency of production. Gender-responsive extension systems, farmers-tofarmers learning, small farm mechanization, and natural resource management were identified as key drivers.
- However, limited access to quality seeds and lack of information on variety management are the main constraints to wider adoption.

decrease in household poverty

3.2: Building Effective Agri-food Systems in India

- A pilot study was conducted to test the feasibility of a proposed randomized control trial (RCT) study on the diffusion of machine harvestable chickpea (MHC) in India and its impact on the labor market. The study showed that using machine harvesters for MHC harvesting results in lower costs with participants willing to pay for MHC seeds and cultivate the crop in the following seasons. The full-RCT study has been implemented and will be available in 2023.
- The Program conducted several scenario and foresight analyses to support policy implementation, inform targeted investments, and scale specific interventions and innovations. For example, in collaboration with the World Food Programme (WFP), the Program conducted a foresight analysis of agriculture, food, and nutrition security in India to explore the future of food and nutrition security under different climatic and socioeconomic scenarios. Our study concluded that context-specific climatesmart and holistic policies need to be formulated and implemented to address plausible long-term challenges of climate change and to meet the country's growing food and nutrition demand.
- As part of applying lessons learnt from different regions, a comprehensive analysis was conducted of the co-benefits and trade-offs associated with climate change mitigation and adaptation strategies within the mixed crop-livestock systems of semiarid Zimbabwe. The findings of this analysis are particularly relevant for vulnerable smallholder crop-livestock holdings regardless of location, as they are most susceptible to the negative effects of climate change. The research focused on identifying economically feasible and environmentally sustainable development pathways that can provide a way forward for diverse farm types. By identifying pathways that balance co-benefits and trade-offs, we are working to create a more sustainable and resilient agricultural sector both in the drylands of India and Africa, that are particularly vulnerable to climate change impacts.
- The Program updated the District level database (DLD) for India up to 2020-21, covering more than
 20 States and 582 districts and included more
 variables and new data sources. New features have
 been introduced in the web portal to enhance access
 and use of the database by policy makers and others.

- A systematic review was undertaken to assess micronutrient-sensitive food value chains and interventions that improve micronutrient delivery and consumption. We focused on production, accessibility, marketing, income, knowledge, and behavioral pathways to combat hidden hunger. The Program also partnered with the World Food Program to study how climate change affects food and nutrition security in India. We used district-level data to determine how food availability, instability, and use are impacted. The Program also studied how rural households generate their livelihoods providing new insights into rural wealth dynamics, showing substantial heterogeneity in the technologies employed by rural households to support their income generation.
- We established a Secondary Processing Unit (SPU) at Anantapur, Andhra Pradesh, India equipped with five processing lines to produce highly nutritious milletand pulse-based Ready-to-Eat (RTE) and Ready-to-Cook (RTC) products. The SPU is expected to benefit around 6,000 farmers.
- The Program conducted a study to understand the demand for millet-based value-added products in Puri and Koraput districts of Odisha, India. Our survey found that finger millet is the most cultivated and consumed millet in Koraput district, but local processing and consumption patterns are limited to de-husking and cleaning. However, the study shows that consumers are open to existing taste palettes of value-added finger millet products and seek convenience in the form of RTC products.

3.3: The Smart Food Initiative

ICRISAT's "Smart Food" initiative continues to make strides with a renewed focus on research and communications. The aim of the initiative is to promote the consumption of food that is good for people, the planet, and farmers. To achieve this, ICRISAT is partnering with organizations such as the World Food Program and the Institute of Rural Economy in Mali, to test and validate new Smart Food recipes. In Mali, for example, 8 new recipes were tested and validated at the Food Technology Laboratory. These recipes were then showcased to target communities through community awareness creation and capacity building efforts. The project also emphasized the promotion of value addition, processing, marketing, and consumption of local products with high nutritional value. To create more awareness, promotional materials were developed in collaboration with NGOs and local radio stations were engaged to broadcast Smart-Food related messages. The initiative has already trained 120 beneficiaries in the preparation of nutritious foods based on millet, sorghum, groundnut, and cowpeas. The "Smart Food" initiative will continue to make inroads and promote healthy and sustainable food choices for communities in Africa, India and beyond.

Publications, Knowledge Transfer and Training

Publications

Policy briefs

J Book chapters

5 Conference outputs and 13 monographs

Research and review papers

Policy Briefs

- Superiority of newly released sorghum varieties for enhancing farm level genetic gains in Tanzania
- Revamping sorghum seed production and supply systems in Tanzania: policy options forward
- Building sorghum seed sector along the grain market in Tanzania: Areas for policy support
- Increasing women's involvement in the workforce can improve dietary diversity

Knowledge Transfer and Training

ICRISAT 50 Celebrations

Mali

Nigeria

Kenya

India

Malawi

Niger

Zimbabwe

ICRISAT 50th Anniversary Stamp Released in India

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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.

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