



RACE FOR IMPACT



Around the world, value chains and food systems are being transformed at a rapid pace. As countries continue to grapple with this reality along with the realities of climate change, pandemics, and increasing poverty and hunger, the International Rice Research Institute (IRRI) stands ready to ensure the sustainability of the global rice sector, which provides food for half the world's people.

For 60 years, IRRI's work on rice has played a pivotal role in increasing agricultural productivity and providing technological and innovative solutions for governments and farmers across Asia and Eastern and Southern Africa and it continues to work with AfricaRice to adapt solutions across African landscapes. As a decentralized international organization, IRRI is able to rapidly move ideas, technology, and people across the globe to accelerate innovation, development, and adoption.

Transforming the world's rice-based agri-food systems and achieving the Sustainable Development Goals (SDGs) are no small challenges. In these crucial times, IRRI is focused on bolstering the resilience of the global rice sector against economic shocks while attempting to help meet the deadlines for many SDG indicators and targets. IRRI is committed to working across its 17 offices and with its trusted network of partners to ensure that in the race for impact, no one gets left behind.



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This year, I was anticipating reporting to you about the positive year we've had at IRRI in 2019. However, as I sit down to write this, 2020 has delivered us a global pandemic that threatens to permanently alter the most fundamental aspects of our lives—not least of all for the rice-based farmers and consumers that we serve.

Our partner governments are facing incredible challenges as a result of the COVID-19 pandemic. Around the world food supply chains have been interrupted and individuals and families face pressing hardship. At IRRI, we have a moral obligation to help our partner governments find the best way forward towards a smooth supply chain, consistent pricing, and adequate support for farmers. We are actively engaging with our partners needs and stand ready to help further as needs become clearer.

Never has the need for transformational change in the agri-food system been more acute than today. While the sudden and acute shock of the COVID-19 pandemic has shaken us from our complacency, we must not forget we are in a world where persistent incremental challenges, climate change, population growth, environmental degradation, continue relentlessly. The interaction between viral pandemic and these ongoing forces will shape our short- to medium-term future.

Over 840 million people worldwide, almost all from developing countries, continue to suffer from chronic hunger. Likewise, the alarming prevalence of malnutrition in children requires our most urgent attention. Income inequality continues to grow year after year and these issues are likely to become more acute now.

The rice sector, which is the cornerstone of food security for half the world's people, faces multiple challenges from both nature and people. The threat of climate change to crop production in major rice-growing regions is further amplified by the dwindling number of rice farmers and a rapidly growing global population. The COVID-19 pandemic will exacerbate the challenges each of these vulnerable groups will face.

We are in a daunting and ambitious uphill race against time. But we are Team IRRI. I have confidence in our time-tested strength and tenacity and, most of all, the power of our network of partnerships.

IRRI has a long history of working effectively with governments and agriculture extension networks across over 30 partner countries (we have an on the ground presence in 17 countries at over 60 sites) to assess local conditions, scale appropriate innovations and make evidence-based recommendations. Based on our trusted experience, we are in a strong position to help the governments of Asia and Africa feed their citizens in the coming weeks, months, and years ahead. However, this requires us to move beyond "research as usual."

As early as 2014, IRRI started building networks to prepare for food systems transformations based on fact-based foresight. We have revisited traditional policy instruments across countries and laid out new policy options that are more in keeping with changing contexts. Our Strategic Plan (2017-2025) and our business plans are focused on building sustainable and equitable rice-based agri-food systems to achieve food and nutrition security, well-being, and prosperity for all. Our strategy will harness the best of human innovation and natural resources to generate the knowledge, tools, and policies that transform rice agri-food systems so that our partners can progress in a sustainable world.

We will make this happen through our Research-for-Development (R4D) agenda in five key areas: Climate Change, Environment, Social Equity, Prosperity and Nutrition and Food Security.



The transformation of the global food systems is an immense but imperative goal to delivering healthier diets without exhausting the world's resources. Making this happen requires restructuring agricultural priorities where the top priority is producing healthier foods for balanced diets rather than producing cheap foods.

Especially under the new normal, the transformation relies heavily on partnership and collaboration across sectors and across countries. I cannot stress enough the value of our donors and partners and the importance of their deep involvement in our efforts to develop technologies to empower millions of the most vulnerable farmers and their families around the world.

In fact, many of our achievements this year are about leveraging the strengths of our collaboration with organizations that share our vision in order to make progress towards a sustainable and sufficient food system.

By engaging more deeply with the public and private sectors, we are able to connect the different agri-food system actors to enable us to bring transformative technologies to farmers' fields faster. Case in point, with our partners, we made history in 2019 with the first agricultural machinery trade in Myanmar.

A year ahead of schedule, we surpassed our goal of reaching 500,000 smallholder farmers across six Asian countries—by more than 100,000!—in promoting best practices for lowland intensive rice production.

Cambodia and Sri Lanka have joined Seeds without Border, the regional seed policy agreement that speeds up the distribution of modern rice varieties across nations in South and Southeast Asia. Additionally, IRRI successfully secured the endorsement of the Association of Southeast Asian Nations (ASEAN) Member States and the support of Plus Three dialogue partners for the launch of the ASEAN Rice Net, a regional network for sharing and evaluating advanced IRRI-developed rice breeding lines.

We also marked the conclusion of the very successful Stress-Tolerant Rice for Africa and South Asia (STRASA) project. STRASA's legacy includes the production and distribution of over 500,000 tons of seeds of stress-tolerant varieties to an estimated 18 million farmers. The project also built an expansive and robust framework for future R4D programs for more productive and climate-resilient rice-based systems in Asia and Africa.

Over 2020, we will see a substantial change as the CGIAR evolves given the decisions taken to embrace and implement the "One CGIAR" initiative. IRRI and the Africa Rice Center have continued our extensive engagement to bring our institutions together to form a single R4D agency.

With our other sister CGIAR agencies, WorldFish, and the International Water Management Institute, we signed a five-year framework agreement to cooperate on the sustainable intensification and management of rice-fish production systems in irrigated landscapes and wetlands in South and Southeast Asia.

These initiatives are designed to expand our opportunity to deliver on our mission to improve the lives of rice farmers and consumers globally.

I am pleased to say that, in spite of tough challenges in 2019, we were able to end the year with weighty accomplishments that empower smallholder and protect the environment.

I appreciate each of you for your dedication and commitment that made these possible in 2019.

And we will stand with our partner governments to help them see their way through the new normal that awaits us all.

Matthew Morell
Matthew Morell
Director General



IMPACT CHALLENGES

IRRI works to find solutions for the world's biggest challenges and contribute to the UN Sustainable Development Goals



CLIMATE CHANGE & SUSTAINABILITY

Utilizing the International Rice Genebank's repository of genetic diversity
Leveraging cutting-edge biotechnology to develop climate-resilient rice varieties
Developing cultivation practices and technologies to minimize greenhouse gases (GHGs)
Enhancing input-use efficiency
Helping predict and respond to climate threats
Working closely with stakeholders to enact climate-responsive measures and policies



NUTRITION & FOOD SECURITY

Developing biofortified rice varieties with provitamin A, iron, and zinc
Breeding novel rice varieties with a lower glycemic index or increased antioxidant content
Improving rice safety by reducing the risk of heavy metal contamination
Supporting crop and dietary diversification in rice-based agri-food systems
Working with partners to ensure access to a sufficient and diverse diet



PROSPERITY

Continuously developing improved varieties that offer:

- Higher yields per hectare
- Greater resilience to biotic and abiotic stresses
- Better grain quality and nutrition

Disseminating innovative crop production practices and tools to enhance productivity

Promoting socio-economic initiatives to promote equity, entrepreneurship, and market access

Leading collaborations to develop networks, education and extension programs, and agricultural strategies toward better food systems



SOCIAL EQUITY

Facilitating and catalyzing people-centered initiatives
Bridging the gap for vulnerable groups dependent on rice-based agri-food systems
Promoting high-quality transdisciplinary research for development in various areas, including:

- Rural women's empowerment
- Better maternal and child health and nutrition;
- Creating opportunities for youth;
- Enhanced smallholder adaptive capacity



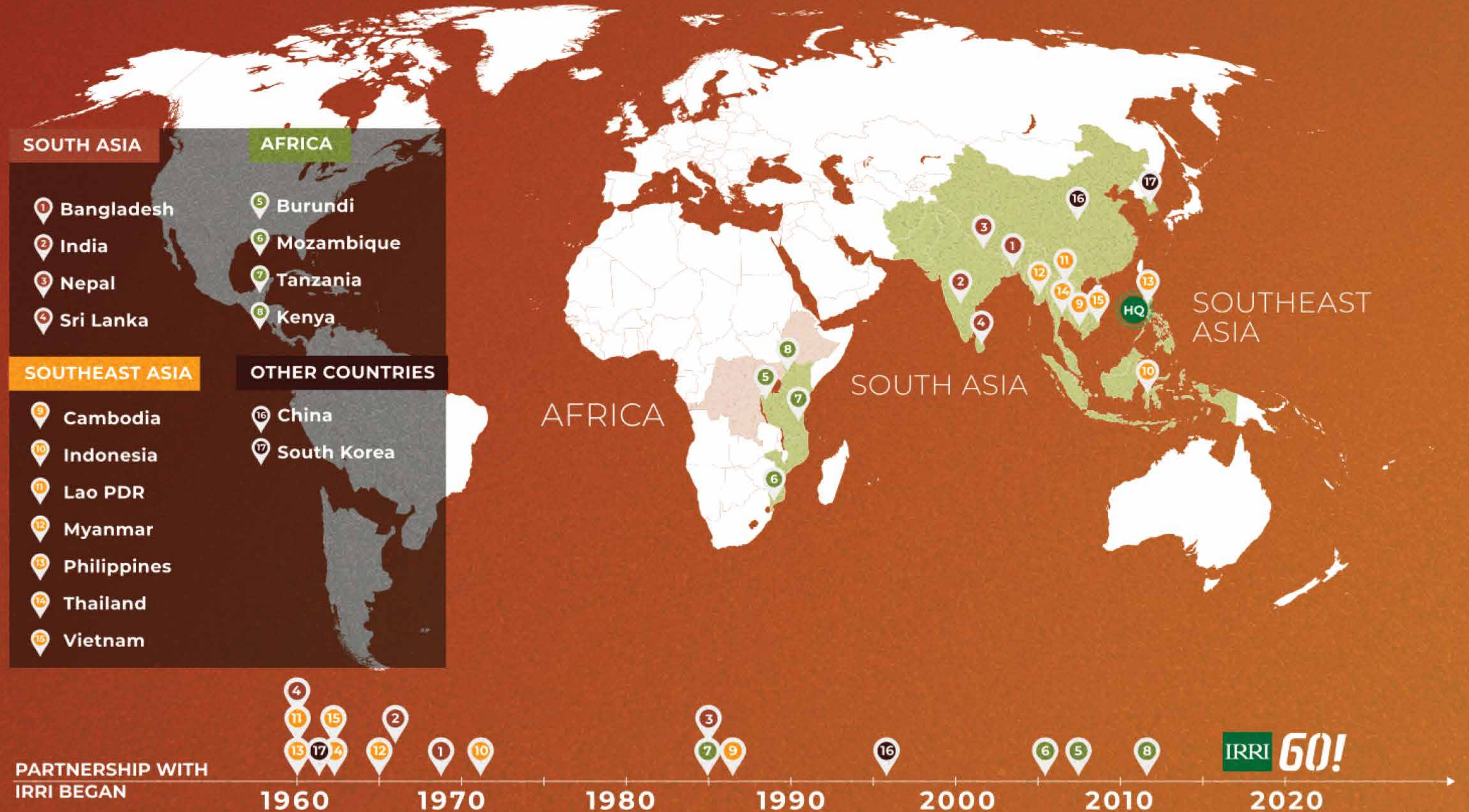
ENVIRONMENT

Improving productivity of, and incomes from, rice-based systems while minimizing environmental footprint
Advancing the environmental sustainability of rice-based agri-food systems through transformative and multidisciplinary research and approaches such as:

- Direct-seeded rice
- Eliminating the need for tillage under flooded conditions,
- Conservation agriculture as well as the use of ICT tools



WHERE WE WORK



A top-down view of a scientist with long brown hair, wearing a white lab coat and green gloves, working with a tray of petri dishes. The dishes contain various colored bacterial cultures, including orange, red, and dark brown. The scientist is using a pipette to transfer liquid from one dish to another. The background is a light-colored tiled surface.

INNOVATE

innovate
catalyze
transform

Be the linchpin of
scientific innovation and
thought leadership for
the global rice sector

The paradigm on which food policies are built is changing rapidly. Today, it is increasingly recognized that agriculture and food policies should align with the 2030 Agenda for Sustainable Development by addressing several human and planet-centered goals through interconnected and complementary impact pathways. To achieve this, IRRI continues to work towards high-impact, scalable innovations that re-focus global solutions to local needs.

TEMPERATE RICE RESEARCH IDENTIFIES NUTRITION, GRAIN QUALITY AS KEY PRIORITIES

Members of the Temperate Rice Research Consortium (TRRC) steering committee renewed their commitment to joint research and collaboration on temperate rice during the 2019 meeting and symposium in Nanjing, China. Hosted by the Jiangsu Academy of Agricultural Sciences (JAAS), the meeting was an opportunity for the consortium to come together after three years and redefine TRRC's new research direction, identify key future research priorities, and evaluate proposed research programs.

IRRI Director General Matthew Morrell emphasized that it was time to embark on a

new direction for the consortium and revisit its key objectives.

"TRRC will leverage on the capacities of IRRI, the Rural Development Administration of Korea, and JAAS, as well as other member institutions, to achieve a renewed research program with a synthesized vision and long-term plans," Dr. Morell said.

As a result of the meeting, it is envisioned that TRRC can demonstrate benefits and impact from RDA investment on the consortium. Specific key research priorities that have been identified for immediate implementation include (1) consumer acceptance traits that will be identified through a common methodology for measuring quality; (2) rice blast resistance; (3) rice with low glycemic index; and (4) nutrition.

TECHNOLOGICAL INNOVATIONS AROUND AT HACK4RICE 2019

IRRI and Amazon Web Services (AWS) organized Hack4Rice 2019, a software/hardware hackathon focused on technological solutions that can be adapted for rice research. Held at the IRRI headquarters in the Philippines, the theme of the hackathon, *Advancing Rice Research Through Tech and Innovation*, aimed to bring people with diverse backgrounds together and nurture a community of collaboration and innovation. Team Blu bagged first place by creating *Saka*. PH, an application that enables farmers to send questions to a centralized knowledge bank and receive answers for free through SMS and feature phones. It also provides stakeholders the necessary data to help them prioritize activities such as capacity-building. Team Pilapil landed second place with *Pilapil*, a mobile application that serves as a career guide to high school students who are about to enter college.

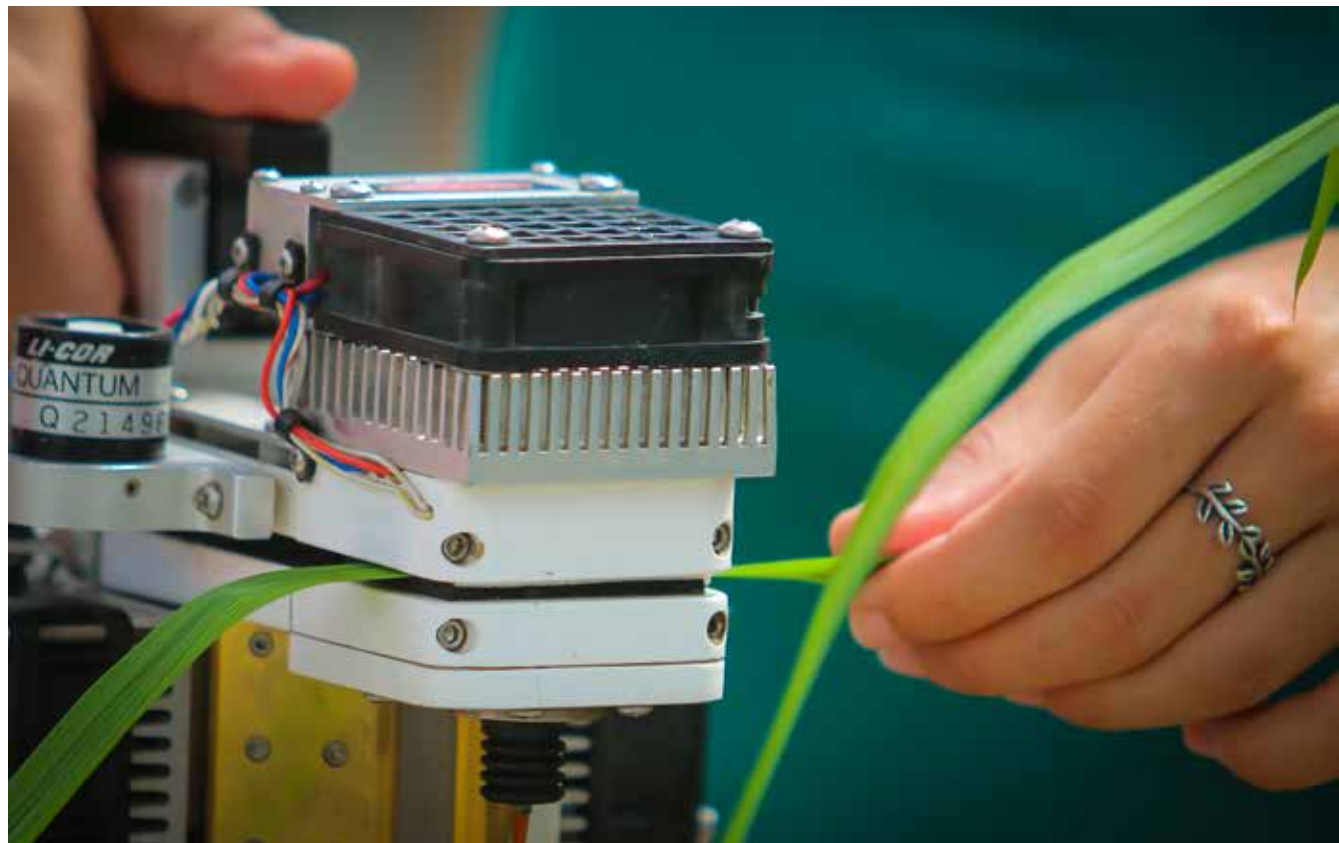
Third place went to team CroppyNet, for creating an inclusive agricultural marketplace by allowing interaction among suppliers and consumers of agricultural products through

SMS, calls, Unstructured Supplementary Service Data, and connected devices in the cloud.

A special award was given to team Humaygosh who took on an IRRI-sponsored challenge on phenotype prediction. The team worked on an artificial intelligence platform where crop breeders can use tools to upload and visualize data, run machine learning algorithms, and collaborate with different domain experts to solve challenging problems in the field.

CLOUD COMPUTING TO HELP THE RICE SECTOR IN THE PHILIPPINES

The agriculture and science community in the Philippines celebrated the launch of *Asi@Connect RICESTATS DATABASE: Leveraging the Cloud for Rice Statistics and Analytics*. RICESTATS DATABASE, which is led by IRRI, intends to create a reference resource by using an ontology to combine data into a one-stop accessible database with a displayable dashboard for rice statistics. The platform runs on AWS such as AWS Glue, Athena, and S3 for data extraction, transformation, and





OUTSMARTING THE ENEMY THROUGH PROACTIVE RICE SCIENCE

IRRI is collaborating with the Healthy Crops Research Consortium to enable the rapid development of rice varieties to be a step ahead of the evolution of rice diseases that can heavily affect yield and smallholder farmer income.

Two recent publications in the journal *Nature Biotechnology* describe, for the first time, an integrated strategy to eradicate diseases that reduce global rice production. This is the case of bacterial blight, a plant disease that affects large areas in Asia and sub-Saharan Africa. The research team behind the publication generated multi-resistant rice varieties as well as a diagnostic kit to recognize new variants of the pathogen.

In the first paper, the scientists were able to generate novel *SWEET* variations that can resist the activation by the pathogen. The new variants prevent the *SWEET* activation and thus the release of sugar. The bacterium fails to get nutrition from the host plant and eventually dies. Essentially, this approach aims to outsmart the bacterium by depriving it of nutrients that it needs to survive and propagate.

GOLDEN RICE IS SAFE AND HAS POTENTIAL TO ADDRESS VITAMIN A DEFICIENCY

An article published in the *Journal of Agriculture and Food Chemistry* in 2019 presented findings showing the nutrient content of Golden Rice, and the potential nutritional impact of the added beta-carotene content.

Conducted by Dr. B.P. Mallikarjuna Swamy and the Healthier Rice Team at IRRI and Philippine Rice Research Institute, the analysis showed the content of key nutritional components, protein content, proximates, and minerals in the paddy rice, straw, and bran of Golden Rice were substantially equivalent to ordinary rice. However, Golden Rice grains contain up to 7.31 ppm of beta-carotene, while ordinary rice had amounts too insignificant to measure.

loading. The transformed data is stored in AWS cloud warehouse Redshift. The database will contain data from existing household surveys conducted by IRRI globally and will include data from national bureaus and international organizations. Currently, such a consolidated database with disaggregated data, such as production by season and gender of household head up to the village level, does not exist for rice in Asia.

IRRI believes Asi@Connect can help fulfill a number of SDGs through improved access to education and research resources across the Asia-Pacific. The project will provide a unique resource for agricultural and social science researchers, academia, policymakers, donors, and investors in the rice sector and beyond.

The results of the compositional analysis show that Golden Rice is as safe as ordinary rice, but with the added benefit of beta-carotene content. The beta-carotene in Golden Rice can easily be converted by the human body into the amount of Vitamin A that it needs.

Previous studies show that the bioconversion efficiency of Golden Rice compares favorably to other beta-carotene biofortified crops, like cassava and yellow maize. Compared to spinach, a vegetable widely recognized as a rich source of vitamin A, the beta-carotene in Golden Rice is converted by the body into vitamin A about five times more efficiently.

THAILAND GEARS UP INNOVATIONS ON LAND LEVELING

The Thai Rice Department, in partnership with IRRI through the Closing Rice Yield Gaps in Asia with Reduced Environmental Footprint Project (CORIGAP), has introduced innovations in rice production. One of these innovations is laser-guided land leveling.

The Phraojen Village is one of the rice-producing areas in Chainat Province that need more water during the dry season. "Although we have an adequate supply of water through the Chao Phraya River, we don't have enough during the dry season so we need to take measures," said Winai Jaengan, the village head.

To overcome this challenge, the village members rely on underground irrigation during the dry season. "This is costly for us because it needs more fuel to pump the water out. Additionally, the farmers use small walking tractors which takes time and more cost to level the field," he added.

Thirty-seven farmers, researchers, and other stakeholders learned about the theoretical and practical concepts of land leveling, including conducting a proper topographic survey and operating a tractor in a safe and efficient way. This new knowledge will enable them to reap the benefits of the technology sustainably.



CATALYZE

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Create and support a network of catalytic agents to drive widespread adoption of high-level innovations and technologies



IRRI provides optimal solutions for changing consumer preferences and nutritional requirements, climate resilience, resource scarcity, and other issues that impact those who depend on rice for food and livelihood. In 2019, IRRI launched multi-stakeholder initiatives around nutritious and climate-resilient rice varieties, sustainable farming practices, and resource-efficient cultivation and mechanization that provide further pathways for improved agri-food systems across Asia and Africa.



GREEN SUPER RICE VARIETIES INCREASE FARMERS' INCOME IN THE PHILIPPINES

Green Super Rice (GSR) farmers in the Philippines have an estimated income advantage of more than USD 231.00/ha. This advantage can reach up to USD 409.00/ha during the wet season, according to a study. With the dramatic climatic shifts, particularly in areas where rice production is dominant and extensive, the benefits that the GSR varieties

could offer may be significant to secure more rice and alleviate poverty in the country.

GSR can produce high and stable yield with less water, fertilizers, and pesticides as these varieties were developed for tolerance to drought, floods, salinity, and other environmental stresses. Funded by the Bill and Melinda Gates Foundations and the Chinese Government, IRRI through the GSR project released 55 varieties in Southeast Asia, South Asia, and East and Southern Africa.

At present, these varieties cover more than two million hectares in 11 countries. More than 5,000 GSR lines have been shared with partners for testing. This includes almost 100 new GSR lines nominated in national cooperative trials in Asia and Africa.

PUBLIC-PRIVATE PARTNERSHIPS DRIVE EFFORTS TOWARD FOOD SECURITY

The complex situation of poverty and food security calls for more strategic research for development initiatives that is reinforced through public and private sector collaborations. Private companies are an important component of such partnerships. More importantly, public-private partnership creates synergy among different actors that enables taking technologies to farmers' fields, so everyone can reap the best returns.

IRRI Director General Matthew Morrell emphasized that engaging with private sectors and partners is about sharing information, connectivity, and scaling impact. At the 2019 IRRI Science Week, scientists and staff gathered to discuss the challenges and key drivers in public-private partnerships that will help the institute widen its global impact. These include rice germplasm sharing, identification and characterization of agronomically important genes, improvement of geological information systems for rice,

improved agronomic practices such as direct seeding and postharvest technologies and mechanization equipment, and lessons and insights in scaling rice research for impact.

IRRI, UN ENVIRONMENT ENGAGE PRIVATE SECTOR TOWARD A LOW-CARBON RICE PRODUCTION

A workshop organized by IRRI and the UN Environment Programme highlighted the importance of involving the private sector in efforts to mitigate greenhouse gas (GHG) emissions in rice production.

"The role of the private sector in promoting the practice of mitigation technologies is pivotal because they have distinct interests in ensuring that farmers implement certain practices," said Dr. Bjoern Ole Sander, climate change scientist and IRRI representative to Vietnam. "Also, they are actively working in almost all stages of the value chain and that cannot be overlooked."

Globally, the agriculture sector contributes 13.5% of the anthropogenic GHG emissions; 11% of which comes from irrigated rice in the form of methane and nitrous oxide. The figures may seem small but not so if we are looking at rice-producing countries where rice production contributes significantly to total national GHG emissions.



DSRC AIMS FOR MORE SUSTAINABLE, ENVIRONMENT-FRIENDLY RICE SYSTEMS

DSRC convened 24 partner members from across the globe to share experiences and learnings from China, India, Cambodia, Thailand, Vietnam, and the Philippines; present DSR-adapted technologies like hybrid seeds, nutrient and weed management, micro-irrigation, drone systems, and mechanization; discuss the workplan for 2019 and strategies moving forward.

"The consortium in its first year has been very successful in bringing together various stakeholders from public and private sectors with expertise and experiences to tackle the complex challenges of DSR," said Dr. Virender Kumar, IRRI scientist and DSRC coordinator.

CORIGAP-PRO SURPASSES GOAL OF REACHING HALF A MILLION FARMERS IN ASIAN RICE GRANARIES

A year ahead of schedule, IRRI, through the CORIGAP-PRO, and its partners from China, Indonesia, Myanmar, Sri Lanka, Thailand, and

Vietnam, have already surpassed its goal of reaching 500,000 smallholder farmers.

"Our efforts in promoting best management practices in rice have reached more than 600,000 farmers with best practices for lowland intensive rice production across six Asian countries," said Dr. Grant Singleton, project leader of CORIGAP-PRO. "About 118,000 farmers have adopted best practices and increased their rice yield by 11-20%, and profit by 15-25%."

This development was confirmed during the CORIGAP-PRO's Third Annual Review and Planning Meeting at the National Agricultural Information and Communication Center in Kandy, Sri Lanka. Young scientists from Sri Lanka, Switzerland, and the Philippines also presented their research initiatives that have the potential to shape the future of rice-based systems.

CAMBODIA SCALES UP RICE STRAW MANAGEMENT

From 2016 to 2018, the BMZ-funded IRRI project *Scalable straw management options for improved livelihoods, sustainability, and low environmental footprint in rice-based production systems* facilitated cross-country learning of best rice straw management practices in Cambodia, Vietnam, and the Philippines.

Based on empirical evidences gathered through fieldwork combined with life cycle assessments, the project devised a decision-making framework each country could find useful for their straw management efforts. This is still work in progress that hopefully the countries will find useful.

"Through the project, we have learned important lessons from Vietnam and the Philippines, who are rapidly progressing in their sustainable rice straw management initiatives," said Meas Pyseth, a postharvest expert on rice. "In Cambodia, we can see opportunities for mechanized straw collection and establishing business models from these, as well as enhancing the mushroom growing business for farmers."



CGIAR RESEARCH CENTERS COMMIT TO FOOD SYSTEMS TRANSFORMATION IN SOUTH AND SOUTHEAST ASIA

IRRI, WorldFish, and the International Water Management Institute signed a five-year agreement that provides a framework for cooperation on research-for-development (R4D) initiatives. The agreement focuses on the sustainable intensification and management of rice-fish production systems in irrigated landscapes and wetlands in South and Southeast Asia.

This partnership helps create better synergies for leveraging individual research expertise and network strengths to accelerate the sustainable supply of nutritious fish and rice into national, regional, and global food systems. Together, the three centers will also be able to better support regional cooperation by increasing awareness, disseminating knowledge, and scaling critical solutions for this intensification to be truly sustainable.

The agreement aligns with the CGIAR 2030 Plan which calls for transformations of its research programs to usher in a "food systems revolution" to tackle challenges related to sustainability, nutrition, genetics, socio-economics, and information and to contribute to the SDGs through greater cooperation among its centers.

ADVANCING BIHAR'S GOALS WITH BETTER RICE VARIETIES

The Government of Bihar's Principal Secretary of the Department of Agriculture Shri N. Saravana Kumar visited the IRRI South Asia Regional Centre (IRRI SARC) to better understand the research and development facility for producing better rice varieties and improving rice-based agri-food systems.

"I'm very impressed with the work being carried out at IRRI SARC," the Secretary said. "Rice is the main staple in Bihar and also India. Going forward, we hope to build robust R&D and training collaboration, working closely with IRRI and IRRI SARC. If we can modernize cultivation of rice and rice-based agri food systems, I see a bright future for our farmer brothers and sisters."

IRRI ISARC supports research collaboration on rice and rice-based agri-food systems, capacity building and training, and niche scientific services for institutions, scientists, and stakeholders working on enhancing agricultural productivity and profitability.



TRANSFORM

A hand holding a red pencil with a silver band is pointing at a document. The document features a grid with yellow diagonal lines, green circles, and a green rectangular block. The background is a blurred image of a document with a grid and colorful shapes.

innovate
catalyze
transform

Establish a track record of delivering successful policy interventions and institutional capacity building programs that underpin the development of equitable and sustainable rice sectors globally

Using reliable scientific evidence, IRRI cuts through a multitude of options and designs appropriate knowledge tools and policy environments. In the last year, IRRI helped fast-track the approval of several high-impact policies, instrumental in strengthening local and regional rice sectors and bringing countries closer to a sustainable, food-secure future.

IRRI BOOSTS SOUTH-SOUTH COOPERATION IN PREPARATION FOR THE 2020 INDIA-AFRICA SUMMIT

IRRI and the Research and Information System (RIS) for Developing Countries in New Delhi organized a round table discussion to tackle challenges and prospects for enhancing India-Africa cooperation on agricultural research and capacity building for development.

Dr. Sachin Chaturvedi, RIS director general emphasized the role of think tanks in India and Africa to facilitate policy dialogues that shape future narratives of research for development in agriculture. Chairing the inaugural session, His Excellency, Ben Joubert, Acting High Commissioner for South African High Commission, highlighted the need to further the Africa Agenda 2063 by optimally using indigenous knowledge for evidence-based policies and said that recommendations from the discussion should feed into the next India-Africa Summit in 2020. He also emphasized the critical role of gender in agriculture since in many African countries, women form the bulk of farmers.

Over 80% of the population in sub-Saharan Africa depends on agriculture where the demand for rice is growing at over 6% per year due to rising population, better incomes, urbanization and shifting consumer preferences. To meet this rising demand, the region imported 16 million tons of milled rice in 2018 at a cost of around USD 6 billion.

“There is a need to build robust rice-based agri-food systems in Africa using the knowledge and overall progress made in India, to increase food production and improve nutrition.” said Dr. Abdelbagi Ismail, IRRI representative for Eastern and Southern Africa.



PHILIPPINES APPROVES GOLDEN RICE FOR DIRECT USE AS FOOD AND FEED, OR FOR PROCESSING

After a rigorous biosafety assessment, Golden Rice “has been found to be as safe as conventional rice” by the Philippine Department of Agriculture-Bureau of Plant Industry. The biosafety permit, addressed to PhilRice and IRRI, details the approval of GR2E Golden Rice for direct use as food and feed, or for processing.

The Philippines joins a select group of countries that have affirmed the safety of Golden Rice. In 2018, Food Standards Australia New Zealand, Health Canada, and the United States Food and Drug Administration published positive food safety assessments for Golden Rice.

IRRI, IFA SPARK DISCUSSION ON SUSTAINABLE AGRICULTURE AT COP25

IRRI and the International Fertilizer Association organized Earth, Air, Fire, & Water: Elements for Sustainability at the 2019 United Nations Climate Change in Madrid, Spain. The session

presented interventions categorized into the 4 “elements” that could contribute to both climate change adaptation and mitigation, from enhancing nutrients in the soil to developing varieties of crops that emit less GHG.

IRRI defined a coherent research portfolio on climate change emphasizing adaptation, mitigation, and policy. This sets rice production into the broader context of food supply and food security alongside socio-economic issues, such as rural development and gender mainstreaming.

Other IRRI initiatives include the development of climate-smart rice varieties that can tolerate adverse climate conditions and poor soils. There are also water-saving and resource-efficient technologies and crop management systems that help reduce resource-use and input, such as micro-irrigation, direct seeding, and ICT tools like AutoMon.

IRRI SECURES ENDORSEMENT FOR ASEAN RICE NET

IRRI successfully secured the endorsement of ASEAN Member States and the support of Plus Three dialogue partners for the launch of ASEAN Rice Net, a regional network for sharing



and evaluating advanced IRRI-developed rice breeding lines.

The endorsement enables IRRI to also liaise closely with the ASEAN Plus Three Dialogue Partners, China, Japan, and the Republic of Korea for the development of both technical and financing support modalities for the network.

The collaborative partnership is underpinned by the Rice Genetic Solutions for Climate Resilience and Value Addition program. The program will accelerate farmers' access to high-value varieties under climate change environmental conditions and drive long-term increases in rice productivity and incomes.

ADB-IRRI EYE INCREASED INVESTMENTS FOR SUSTAINABLE AGRICULTURE TECHNOLOGIES

The Asian Development Bank (ADB) and IRRI completed a technical assistance project which aims to help governments identify and prioritize appropriate climate-resilient agricultural technologies and practices for high-impact investment.

Under the Investment Assessment and Application of High-Level Technology for Food Security in Asia and the Pacific, IRRI and select national research organizations piloted the project *Climate-smart practices and varieties for intensive rice-based systems in Bangladesh, Nepal, and Cambodia*. The pilot includes a) identification of constraints, policy, institutional support, and logistics needed to scale up climate-smart water-saving mechanized technologies; b) demonstration of climate-smart agricultural practices (CSAs) related to rice-based systems; and (c) development of a database along with evidence of benefits from CSAs using participatory approaches.

Technologies and methods tested included alternate wetting and drying (AWD) and mechanized direct-seeded rice, the distribution of high yielding rice varieties with short duration and better grain quality, and the introduction of mechanization for crop establishment and rice harvesting. The intensification and diversification of rice-based cropping systems in target areas were also prioritized for the pilot.

IRRI PARTNERS WITH SOCIAL ENTERPRISE TO INCUBATE WOMEN'S PRODUCER COMPANY

As a concerted effort to test various models of women's entrepreneurship development in rice agri-food systems, IRRI has partnered with Access Livelihoods Consulting (ALC) India in the Dharmagarh and Kokasara blocks of Kalahandi district, Odisha to incubate a rural women-producer enterprise with 3,000 women farmers.

In the two selected blocks of the district, more than 80% of the farmers are small and marginal with an average land-holding of less than 1.2 hectares. In Kokasara, 80.9% of the cropping area is rainfed and in the Dharamgarh block, 40% of the area is under canal irrigation. 34.8% of the women belong to the Scheduled Tribal community with an average annual income of below USD 529.00 and a major part of their income comes through paddy farming.



The Producer Company will provide all the services which include inputs (seed, fertilizers, bio-pesticides), agricultural machinery, financial services and marketing for its members, and facilitate access to the latest technologies in production, processing, information and traceability. It will facilitate linkages with multiple stakeholders like government, financial institutions, knowledge institutions, and markets and also create adequate risk coverage mechanisms.

CAMBODIA AND SRI LANKA JOIN SEEDS WITHOUT BORDERS

Cambodia and Sri Lanka have joined a regional seed policy agreement that speeds up the distribution of modern rice varieties across nations in South and Southeast Asia. The two countries formally entered *Seeds without Borders: Regional cooperation for seed-sharing* during a meeting of agriculture ministers and representatives from Cambodia, India, Bangladesh, Nepal, Myanmar, Sri Lanka,

Thailand, Laos, and Vietnam in June 2019 in Siem Reap.

"What we have seen here today is an example of how effective national leadership and vision can lead us to a future where nations are connected by seeds without borders," said IRRI Director General Matthew Morell. "Agro-ecological zones and the effects of climate change don't stop at borders, so the availability of high-quality seeds shouldn't either."

Originally signed by India, Bangladesh, and Nepal in 2014, the agreement will now expand to include other crops, in addition to rice.

"Making a variety of agricultural crops available across borders is a major step forward for farmers and national agricultural systems," Dr. Morell said. "The extension of this agreement to include other crops means signatory countries gain an added benefit from the high degree of cooperation that we have already achieved by working together on rice for so many years."



GLOBAL HIGHLIGHTS

STORIES ON TRANSFORMING FOOD SYSTEMS

Evidence Hubs in Odisha help farmers select the best seed varieties

Through "Evidence Hubs", IRRI showcases high-impact innovations and technologies to solve complex problems and serve our beneficiaries. Together with Odisha's Department of Agriculture, an Evidence Hub event was organized to strengthen seed systems of STRVs and to produce and drive widespread adoption of high-quality seeds.

2

Making inroads for food security through cutting-edge farming technology

Through 'Assam Agribusiness and Rural Transformation' (APART), smallholder farmers and agro-entrepreneurs in 16 districts gain new technological skills to aid in better decision-making, so that yield gaps are reduced, incomes are increased, and the sustainability of rice-based agrifood systems is improved.

2

IRRI and Mozambique strengthen collaboration and join efforts to establish regional center of leadership for rice

The International Rice Research Institute (IRRI), Agriculture Research Institute of Mozambique (IIAM), and the World Bank funded project Agricultural Productivity Program for Southern Africa (APPSA) explore opportunities to collaborate in the establishment of the Regional Center of Leadership (RCoL) for Rice.

6

Myanmar farmers and extension workers adopt best postharvest management practices

Extension agents of the Department of Agriculture (DoA) and farmers from Sagaing region underwent a two-day hands-on training and participated in discussions about best practices in rice postharvest management. Through field discussions and hands-on exercises, the participants learned the principles of mechanized harvesting, drying, hermetic storage and understanding rice quality.

12

Advancing pest resilience through molecular breeding in Cambodia

Funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and coordinated by the International Rice Research Institute (IRRI), the VERDE project aims to develop smart deployment of pest-resistant genes, test ecological engineering mechanisms for managing rice pests, and reduce pesticide dependency without negative impacts on yield.

9



AWARDS & ACCOLADES

ABDELBAGI ISMAIL RECEIVES FELLOWSHIP OF NATIONAL ACADEMY OF AGRICULTURAL SCIENCES

Abdelbagi Ismail, IRRI representative for Eastern and Southern Africa received the prestigious Fellowship of the National Academy of Agricultural Sciences, India as a foreign fellow. The fellowship was bestowed upon Dr. Ismail in recognition of his outstanding contributions to understanding tolerance of drought, cold, and heat in dry-land crops, as well as for salinity and different types of flooding stresses in rice. He also contributed to developing phenotyping tools, markers, and varieties which generated significant impacts in South and Southeast Asia, and in Sub-Saharan Africa.



IRRI RESEARCHER WINS BEST SCIENTIFIC POSTER AT PRESTIGIOUS ASIAN GENOMIC CONGRESS

Lawrence Uy, a researcher at IRRI's Genetic Transformation Laboratory, received the award for best scientific poster presentation at the 6th Plant Genomics and Gene Editing Congress Asia in Malaysia in July 2019. The poster, *Gn1a and TGW6 Targeted Knock-Down via Genome Editing Increases Yield Components*

in Samba Mahsuri, featured research on how grain number and grain weight can be significantly improved through targeted knock-down of gene regulators using CRISPR-Cpf1.

Also acknowledged were Mr. Uy's co-authors Drs. Yvonne Ludwig and Inez Slamet-Loedin from IRRI and Drs. Merlyn Mendiolo, Ma. Carmina Manuel, and Jorge Angeles from the University of the Philippines.

MYANMAR RECOGNIZES IRRI CONTRIBUTIONS

Myanmar's Department of Agricultural Research acknowledged IRRI's valued partnership and contributions to the country's agriculture sector during its 65th anniversary celebration.

IRRI and Myanmar have been collaborating on rice research for more than half a century, beginning with the 1967 introduction of the high-yielding IR8 rice variety (locally known as Yar Gyaw). Recent key achievements include the development of the Myanmar Rice Sector Development Strategy and Climate-Smart Agriculture Strategy, the release of 81 IRRI rice varieties, the dissemination of post-harvest technologies and best crop management practices, and building institutional capacity.



IRRI PASSES GLOBAL STANDARDS IN STEWARDSHIP FOR ITS BIOTECH RESEARCH

IRRI is now recognized by the Excellence Through Stewardship (ETS) Organization after its successful completion of the audit cycle under the ETS Global Audit Process.

The ETS, a global not-for-profit organization, drives the universal adoption of stewardship programs and quality managements systems for the full life cycle of agricultural technology products biotech research. Members include agriculture research leaders Bayer CropScience, BASF Plant Science, Mahyco, and Syngenta. Through the membership, IRRI will have access to expert advice and guidance in the implementation of its stewardship programs and quality management systems, and an independent third party audit to verify them.

FORMER VIETNAMESE MINISTER OF AGRICULTURE APPOINTED AS MEMBER OF IRRI BOARD OF TRUSTEES

Cao Đức Phát, the minister of Agriculture and Rural Development (MARD) from 2004 to 2016, was recently appointed as a new member of IRRI's Board of Trustees effective January

IRRI SCIENTIST WINS BEST POSTER PRESENTATION AT 2019 KSBS SABRAO INTERNATIONAL CONFERENCE

MK Hossain from the IRRI-Bangladesh Office won the best poster presentation at the 2019 International Conference on Plant Breeding for Sustainable Development in Gwangju City, South Korea.

The poster, *The promise of genomic selection in breaking yield ceiling in rice*, illustrates how IRRI's high throughput molecular markers and data-driven breeding decision-support tools reduce breeding cycles 2-3 fold and make it easier to select for best traits. The poster was authored by Dr. Hossain in collaboration with IRRI Bangladesh Plant Breeding team led by Dr. Mohammad Rafiqul Islam, and partners from the Bangladesh Rice Research Institute and the Bangladesh Institute of Nuclear Agriculture.

2019. During his time as head of MARD, Dr. Phát enabled IRRI to have an active role in the development of the rice restructuring plan of Vietnam. He was also instrumental in strengthening the research and capacity building collaboration between IRRI and the Vietnam Academy of Agricultural Sciences (VAAS).

STATEMENT BY THE CHAIR OF THE IRRI BOARD OF TRUSTEES FOR THE YEAR ENDED 31 DECEMBER 2019

2019 was a significant year with regards to the advancement of IRRI's mandate of creating impact. The institute continues to pursue and strengthen relationships with governments and private sector partners around the world, taking the lead in strategic initiatives and supporting transformative innovations in both policy and technology. Research remains a core strength, as numerous projects in IRRI Headquarters, the South Asia Regional Centre in India, and the regions gain momentum and deliver key outputs. While the global financial situation continues to be challenging, enhanced management of resources and fiscal responsibility have led to the institute's first net surplus in six years.

FINANCIAL HIGHLIGHTS

IRRI continues to be the lead center for the CGIAR Research Program on Rice (RICE CRP), joined by the Africa Rice Center (AfricaRice), the International Center for Tropical Agriculture (CIAT), and over 600 other partners across the globe. RICE CRP aims to address nine of the 17 United Nations Sustainable Development Goals (SDGs) and 26 of their 169 targets. The RICE CRP has been approved for operation through 2021.

Despite continued budget cuts in the CGIAR Fund in 2019, IRRI's financial position remains stable, with total assets of USD 73.664 million compared with USD 83.829 million in 2018. The decrease of USD 10.165 million was balanced by a corresponding decrease in total liabilities and net assets. The liquidity and long-term stability indicators remained above CGIAR benchmarks. After six (6) consecutive years of losses, IRRI reported a net surplus of USD 1.187 million in 2019.

In 2019, IRRI's grant portfolio was USD 63.791 million, which included USD 4.063 million

of RICE CRP Windows 1 and 2 funds for the flagship expenses of our CGIAR partners, AfricaRice and CIAT.

In 2018, the Institute's financial statements became fully compliant to International Financial Reporting Standards (IFRS) and are now aligned with international quality standards for financial reporting that are recognized inter alia by donors, the banking industry, partners, and potential collaborators. Further, compliance to this standard allows for comparability with other organizations and enhances the annual audit report.

EXCELLENCE IN RESEARCH

IRRI continues to advance cutting-edge research and research support for the benefit of its partner countries and the global scientific community. In November, the institute and its collaborators launched Asi@Connect RiceStats Database, a cloud-based resource for rice sector statistics and analysis. The platform, the first of its kind in Asia, consolidates socio-economic and other data from disaggregated local and international sources and provides an accessible one-stop reference for agricultural and social scientists, academia, policymakers, and other stakeholders.

Our scientists are also opening up new fronts in the race against one of agriculture's most implacable foes, bacterial blight. Published in Nature last October, IRRI and its partners in the Healthy Crops Research Consortium have been able to replicate, through genome editing, a tactic some rice varieties have against invading pathogens - starving the disease of the nutrients it needs to survive and spread. While research and trials are still ongoing, this pioneering and innovative approach has exciting possibilities down the road for broad-spectrum pathogen resistance, not just for rice but also for other crops such as wheat, corn, and cassava.

The institute's commitment to rigorous and world-class science is duly reflected in our recent accreditation by Excellence Through Stewardship, a global nonprofit that promotes universal standards for stewardship programs and quality management systems. While

the audit period usually takes three years, IRRI was able to complete it in just two, a remarkable feat that attests to the expertise and dedication of our managers and scientists.

PARTNERSHIPS FOR IMPACT

In April, IRRI sat down with CGIAR sister centers WorldFish and the International Water Management Institute to sign a five-year agreement for research for development cooperation in enhancing rice-fish production systems in South and Southeast Asia. This new partnership, which builds on previous successful collaborations by the three institutes, is aligned with CGIAR plans to usher in a food systems revolution by 2030, and serves as a model for greater cooperation between centers in tackling multifaceted global challenges.

IRRI is also strengthening its presence in Africa through a new partnership with the African Agricultural Technology Foundation. Their extensive network in 23 African nations will greatly contribute to IRRI's delivery of improved seed varieties and sustainable practices to smallholder farmers and can lay the groundwork for the institute's long-term commitment and impact to the African rice sector.

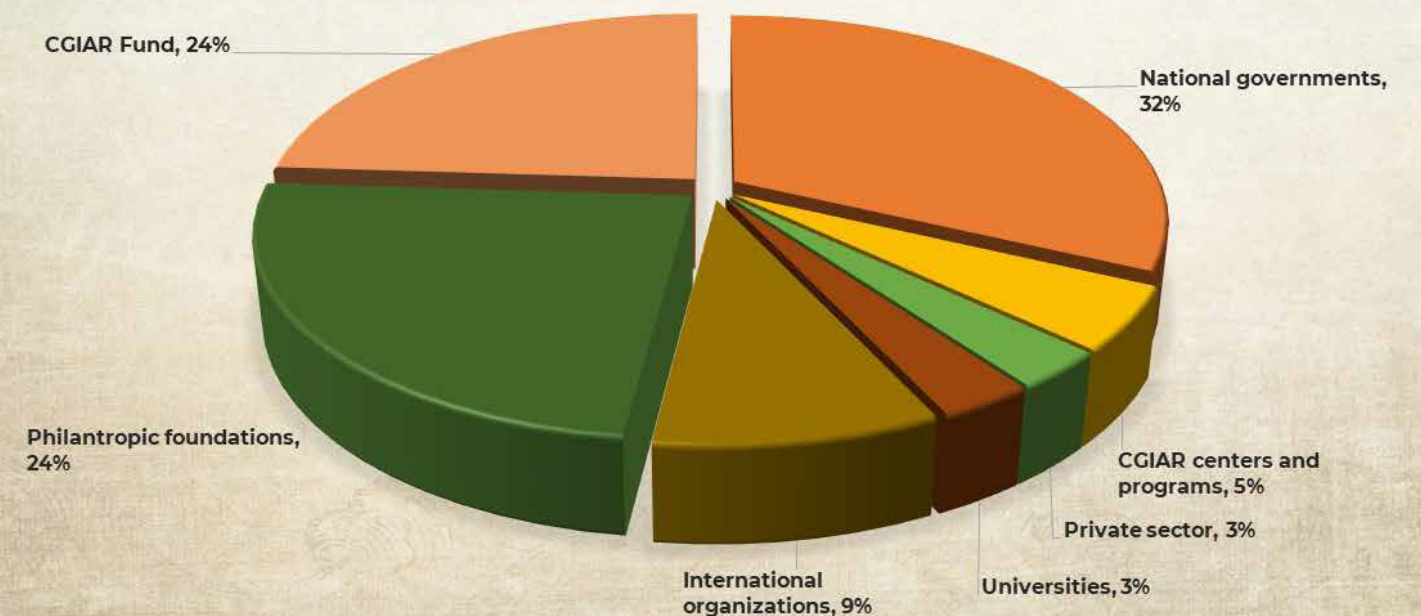
TRANSFORMING FOOD SYSTEMS

Other highlights of the year include the landmark approval of Golden Rice for direct use in food and feed or for processing in the Philippines; the publication of a study that shows Philippine farmers enjoyed a significant income increase of around \$231USD per hectare through the use of resource-efficient Green Super Rice varieties; and the report that the CORIGAP-PRO project surpassed its goal a year ahead of schedule, disseminating rice cultivation best practices to over 600,000 smallholder farmers across six countries.

As we race to create an impact on global rice systems in accordance with the Sustainable Development Goals, the Board would like to extend its gratitude to all IRRI staff and management for their commitment to the institute's mission, and also to our global partners and investors for supporting us in our efforts.


Jim Godfrey
 Chair
 Board of Trustees

FINANCIAL HIGHLIGHTS



OUR INVESTORS

We are grateful to governments, international institutions, and public and private organizations for their trust and confidence in our ability to create long-term and sustainable impact towards global food security and the alleviation of hunger and poverty across the ricegrowing world.

Bill & Melinda Gates Foundation

Republic of India

- Assam Rural Infrastructure & Agricultural Services Society
- Department of Biotechnology
- Department of Agriculture, Cooperation, & Farmers Welfare
- Government of Andhra Pradesh
- Government of Karnataka
- Government of Odisha
- Indian Council of Agricultural Research

Global Crop Diversity Trust

Government of Japan

- Japan International Cooperation Agency (JICA)
- Japan International Research Center for Agricultural Sciences (JIRCAS)
- Ministry of Agriculture, Forestry and Fisheries (MAFF)
- Ministry of Foreign Affairs (MOFA)
- Department of Agriculture Bureau of Agricultural Research
- Department of Agriculture Bureau of Plant Industry
- DA Regional Field Offices - ARMM, CAR, I, II, IVA, IVB, V, VI, VIII, IX, X, XI, XII, XIII
- Land Bank of the Philippines
- Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)
- Philippine Rice Research Institute (PhilRice)

People's Republic of China

- Chinese Academy of Agricultural Sciences (CAAS)
- Provincial Government of Yunnan
- Ministry of Agriculture - Department of International Cooperation

Republic of Germany

- Federal Ministry for Economic Cooperation and Development (BMZ)
- Deutsche Forschungsgemeinschaft (German Research Foundation)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Nama Facility

Republic of the Philippines

- Department of Agriculture Agricultural Training Institute

- Department of Agriculture Bureau of Agricultural Research
- Department of Agriculture Bureau of Plant Industry
- DA Regional Field Offices - ARMM, CAR, I, II, IVA, IVB, V, VI, VIII, IX, X, XI, XII, XIII
- Land Bank of the Philippines
- Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)
- Philippine Rice Research Institute (PhilRice)

Swiss Agency for Development and Cooperation

The World Bank

United Kingdom of Great Britain and Northern Ireland

- Biotechnology and Biological Sciences Research Council (BBSRC)
- UK Space Agency

United States of America

- National Science Foundation
- United States Agency for International Development (USAID)
- United States Department of Agriculture (USDA)

- European Commission
- International Fund for Agricultural Development (IFAD)
- Rural Development Administration (Korea)
- Syngenta Asia Pacific Pte. Ltd.
- United Nations Food and Agriculture Organization (FAO)
- United Nations Environment Programme Access Agriculture
- Australian Centre for International Agricultural Research
- African Development Bank
- Asian Development Bank
- AXA Research Fund
- Bayer
- Catholic Relief Services
- Central de Achat & Prestations
- CIRAD Agricultural Research for Development
- Commonwealth Scientific and Industrial Research Organisation
- Council of Agriculture of the Republic of China
- DKT Liberty Project

- General Directorate of Agricultural Research (Turkey)
- Mr. George Chung Hang Liang
- International Initiative for Impact Evaluation (3ie)
- Instituto de Investigacao Cientifica Tropical Kingdom of Thailand
- Lee Foundation
- Ministry of Agriculture, Livestock, and Irrigation (MOALI)
- People's Republic of Bangladesh Provi, Inc.
- Reliance Industries Limited
- Republic of Indonesia
- Republic of Korea
- Republic of Mozambique
- Republic of Turkey
- Rothamsted Research Limited
- Socialist Republic of Vietnam
- United Nations Development Programme
- United Nations Industrial Development Organization (Vietnam)
- United Nations Women

OUR PARTNERS

We work with organizations and institutions from around the globe to drive research and innovation for humanity's most important food crop. These partners provide valuable support and collaboration that expand and accelerate the institute's impact to farmers and communities across the rice-growing world.



CGIAR

- AfricaRice
- Bioversity International
- CGIAR Fund
- HarvestPlus
- International Center for Tropical Agriculture
- International Crops Research Institute for the Semi-Arid Tropics
- International Food Policy Research Institute
- International Institute of Tropical Agriculture
- International Maize and Wheat Improvement Center
- WorldFish

Universities

- Aberystwyth University
- Cornell University
- Cranfield University
- Heinrich Heine University of Duesseldorf
- Imperial College of Science, Technology, and Medicine
- Kansas State University
- Nagoya University
- National Academy of Sciences, USA
- New York University
- The National Institute of Agricultural Botany
- Pennsylvania State University
- Université Catholique de Bukavu
- University of California, Berkeley
- University of Cambridge
- University of Nottingham
- University of Oxford
- University of Sheffield
- University of South Carolina
- University of the Philippines Los Baños
- University of York
- University of Zurich
- Virginia Polytechnic Institute and State University
- Wageningen University



RICE IS THE WORLD'S MOST IMPORTANT FOOD FOR SOME **4 BILLION PEOPLE**

GLOBAL RICE DEMAND WILL INCREASE BY UP TO **25% BETWEEN 2010-2030**

BUILDING FARMERS' CAPACITY AND IMPROVING THEIR INCOMES



Indonesia's average annual value of gains from IRRI is equivalent to or more than US\$76/ha across the average rice area

Filipino rice farmers are earning an additional US\$52 annually using IRRI-bred rice varieties

The average annual value of the gains from IRRI is equivalent to US\$127/ha or more across the average rice area in southern Vietnam

Through the farmer field school (FFS), more than 1,800 women farmers in ESA have been trained

BOOSTING PRODUCTIVITY



Nearly 1/4 of India's rice genetic improvement accounted for IRRI's germplasm contributing about 14.4 million tons of annual rice production

IRRI rice varieties and technologies helped nearly double the rice productivity in Nepal

Rice yields in Bangladesh increased from 1.6 t/ha in 1971 to 4.8 t/ha today.

IRRI's support for laser land leveling has helped increase rice yields in Cambodia by 24% per hectare

IRRI contributed to the development of 80% of 132 improved rice varieties and played a vital role in increasing its rice production and food security.

In Burundi, IRRI-bred varieties yield 6.5-7 t/ha exceeding the global average of around 4.4 t/ha

LEVERAGING INNOVATION FOR CLIMATE-SMART SOLUTIONS



3CT (three controls technology) has reached over 200,000 farmers across most of China's rice-producing provinces decreasing nitrogen fertilizer and pesticide use by up to 20% and increasing yield by up to 10%

IRRI works with Vietnam on climate-smart agriculture (CSA) for rice production, evaluation of CSA practices (e.g., alternate wetting and drying, climate-smart varieties, and ICT-based climate information) and mechanization and scaling approaches

A WORLD WITH IRRI

2019

IRRI BY THE NUMBERS



38 Nationalities

17 Offices worldwide



321 Undergraduate, Graduate, intern, DJT, and PDF



118 New staff



33,095 Farmers, researchers, extension agents, scientists, heads of institutions that participated in training conducted by IRRI



1,031 IRRI staff worldwide

109 Recruited globally

922 Recruited nationally

40% are women

15% are 30 years old or below



PROJECTS

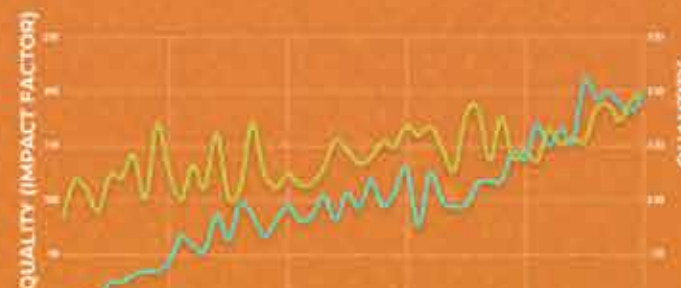
188 total
84 ongoing
84 completed

\$274,629,544.94 total value

STAFF PUBLICATIONS

225 Journal articles

40 Books or chapters



IRRI GENE BANK

132,143 total available accessions from more than 130 countries of origin

5,309 samples distributed outside CGIAR Centers

4,545 samples distributed within IRRI and CGIAR Centers

122,026 accessions safety duplicated in Svalbard Global Seed Vault and National Laboratory for Genetic Resources Preservation



International Rice
Research Institute

IRRI aims to abolish poverty and hunger by improving the livelihoods and nutrition of people who depend on rice-based agri-food systems. In doing so, IRRI's work protects the health of farmers, consumers, and the environmental sustainability of rice farming in a world challenged by climate change. IRRI also promotes the empowerment of women and supports opportunities for the youth in an equitable agri-food system.

irri.org

