



ANNUAL REPORT 2021

THE DRIVE TO THRIVE

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THE DRIVE TO THRIVE



The big transition was one that everyone around the world had to make, as the pandemic entered its second year and forced all nations, organizations, and individuals to discover and adapt to a “new normal” way of working and living. The other big change is the ongoing One CGIAR transition, where IIRI and 11 other centers scattered around the globe are being integrated into one unified system, with all the attendant adjustments that such a transformation entails.

And yet, even with all the challenges brought about by these transitions, IIRI has not just remained resilient but has also found ways to thrive. While field and lab activities were constrained, our scientists were able to find alternative pathways to advance research, such as publishing a bumper crop of papers and studies. While face-to-face visits and engagements dropped, partnerships and relationships continued to be created and strengthened through cloud-based video communications apps, webinars, and other virtual channels.

Furthermore, we have been able to maintain and even grow our funding support with donors and partners recognizing the importance of agricultural research in ensuring global food security in the face of climate change and other emerging threats.

All of these have put IIRI in a strong position as we move into the next phase of the One CGIAR transition and continue our journey towards becoming an even greater force for good.

Despite IIRI teams and CGIAR colleagues being geographically apart, we were able to come together online to effectively complete tasks, communicate information, and collaborate as the new CGIAR takes shape.

Everyone performed above and beyond in this aspect, actively participating in the One CGIAR transition, asking important and difficult questions, and even taking on leadership roles and responsibilities that are out of the scope of their usual duties.

The year 2021 was a time of transition for IIRI in more ways than one.

Across the research initiatives and corporate functions, there was a palpable sense of excitement, as well as some apprehensions, about what the future holds for all of us. But there was also an overriding optimism that the new CGIAR will have an even greater impact on food systems around the world. This optimism was evident in the many constructive and far-reaching discussions that took place throughout the year, as well as the level of engagement and the quality of work that we have seen produced by IIRI staff.

Now we are at a point where we are almost ready to go back on-site with most of the staff that was home-based during the pandemic. We have also started to see some of our international staff return to Laguna and Manila, even as we maintain a flexible and blended approach that will enable us to work both on- and off-site.

Wherever we find ourselves working, I am confident in IIRI's ability to deliver, as our staff has shown that they are more than up for the task, no matter what challenges come our way.

Of course, all these would not be possible without the overwhelming support from partners, donors, and other stakeholders. I would like to take this opportunity to express my sincere gratitude to all of you for your trust and confidence in IIRI.

The past two years have been equally challenging for all, but I am hopeful that the worst is now behind us. With a new CGIAR to lead us forward, I am positive we can better maximize the support we are receiving and we can more effectively contribute to solving the challenges at hand.

In the coming months, we will continue to help drive the One CGIAR transition forward, working hand-in-hand with our colleagues in the other centers to ensure a smooth and successful integration. Many of the staff have built strong working relationships with CGIAR counterparts and I am confident that they will maintain and strengthen these as we move forward.

More specifically, we will be pushing forward to improve the CGIAR value proposition and strategically position the CGIAR Regional Hub for Southeast Asia and the Pacific. These are two areas where we've seen significant improvement and where many partners have been extremely receptive, more than we ever imagined.

We have received valuable ideas and suggestions from all over, and we are confident that with the continued engagement and support of our partners, we can

make the CGIAR an even more effective platform for agricultural research for development.

We will also intensify our efforts in knowledge management and communications, to ensure that the valuable work being done by our scientists and staff, in collaboration with partners, is effectively disseminated and used to its full potential.

IIRI has always been a strong proponent of knowledge sharing, and we will continue to invest in this area to make sure that our research results are accessible and useful to all those who need them.

In 2021, we have seen the benefits of this increased focus, with a number of our products being used by various stakeholders, both inside and outside of CGIAR. Our experience and expertise continue to be sought after and we will strive to build on this moving forward.

We are focused on developing our people and putting in place systems and structures that will enable us to operate more effectively and efficiently while ensuring the safety and well-being of our staff.

We are also keen on harnessing technology to its maximum limit so that we can continue to find new and innovative ways of working and doing things, even as we maintain the high standards of excellence that have always been the hallmark of IIRI.

Of utmost importance to IIRI's work are the local and regional partnerships we have developed over the years. We will continue to nurture these relationships, as we strive to ensure that our work is relevant and responsive to the needs of the most vulnerable. We will also be looking at ways to expand our partnerships in and beyond the region so that we can share our knowledge and expertise with a wider global audience.

We have come a long way in the past two years and I am proud of what we have accomplished together. I would like to thank all of you for your support and I look forward to working with you in the months and years ahead.

Sincerely,

Dr. Jean Balié
IIRI Director General
CGIAR Regional Director - Southeast Asia and the Pacific

THE DRIVE TO MOVE FORWARD IN PANDEMIC CIRCUMSTANCES

The year 2021 was a “wildcard” year for IRRI, and for most of the world, after the global shockwave from the COVID-19 pandemic that started in 2020. The fallout from the economic upheaval, social turmoil, and uncertainty left the world seemingly suspended in time, a year into the unprecedented health crisis. While hoping that the worst had passed, we were left wondering and waiting for what the pandemic would bring. This forced us to face every day with educated guesswork: do we take the next steps in our endeavors or do we continue to be on the safe side?

As the situation made it clear that business-as-usual was not an option, we decided to creatively adapt, plan, and deliver under the “new” conditions. For example, most meetings, including high-level ones, were held online in consideration of various time zones. We had to limit the number of staff that could conduct on-site research, and find ingenious ways to ensure that the quantity and quality of our outputs were not

compromised. We adopted these changes as quickly as possible, built our resilience and strengthened our resolve to come out stronger.

Despite the challenges with the lockdowns and strict health protocols to ensure the safety of IRRI staff, I am happy to report that our team of scientists, researchers, and support staff achieved a number of notable milestones in 2021.

At the core of our research is the mandate to generate novel rice varieties that help alleviate hunger, malnutrition, and poverty, and combat certain non-communicable diseases in the rice-consuming regions where such problems are more common. To these ends, we demonstrated the genetic basis of increasing yield without the classical trade-off in grain quality, and generated pre-breeding lines towards such varieties. We also identified the genetic basis for low glycemic index (GI) rice and are now in a position to convert most

rice varieties into low-GI rice. This will decrease the chances of developing obesity and diabetes.

We also provided support on the approval of commercial propagation of Golden Rice in the Philippines. In partnership with our fellow CGIAR centers, we were able to identify the role of cereals in addressing hidden hunger. This is a step towards developing more nutrient-rich varieties of not just rice but other staple crops as well. Rice productivity is restrained through many biotic and abiotic stresses. Our attempts at pyramiding multiple stress tolerance in selected varieties made appreciable strides especially in relation to diseases in Africa such as the rice yellow mottle virus.

We were also able to reinforce our scaling-up projects with site-specific nutrient management, water management, and seed distribution apps. The Rice Crop Manager app was especially successful and adopted by the Philippines, with a sister project starting soon in Indonesia. We generated critical maps for rice fallows, methane emission, soil type, and other climate change factors.

Through various strategies, we were also able to produce outcomes that are useful for our partners and stakeholders. For example, we reinitiated the policy dialogue on Seeds Without Borders and created a network of our NARES partners.

Given the constraints brought up by the pandemic, and a changing landscape for research as we joined One CGIAR, we prioritized flagships to bring a paradigm shift in rice-based agri-food systems. Direct Seeded Rice is one, a method that we support and recommend because of its economic and environmental benefits.

Nutritious Rice, Climate-resilient Farming, and Accelerated Impact are the other flagships that are product-driven, time-sensitive efforts. Under the Accelerated Impact Flagship, IRRI Education demonstrated its ability to sustainably integrate education and capacity development activities through virtual modes as necessitated by the pandemic. The flagships concept is a dynamic approach to prioritizing proximal deliverables. We have been working on formalizing this approach with our Board of Trustees and CGIAR.

While face-to-face interactions have been highly limited during the past year, we found ways to further establish scientific partnerships. This was done through efforts in collaborating with our partners on a number of webinars and articles that speak to the work that we do in the areas of climate change, food security, nutrition,



gender, livelihoods, the environment, and policies, among others.

Over the past year, our scientists and researchers have also collaborated with other centers to develop 19 of the 32 initiatives that are identified in the new CGIAR portfolio. A number of our colleagues are at the forefront of these efforts, leading the development of the proposals for six of these initiatives: ClimBeR: Building Systemic Resilience Against Climate Variability and Extremes, Excellence in Agronomy, Market Intelligence and Product Profiling, SeedEqual, Securing the Food Systems of Asian MegaDeltas for Climate and Livelihood Resilience, and Precision Breeding.

The abovementioned efforts are capped off by the more than 240 papers published in notable research journals by the end of 2021.

Our desire to deliver the best outcomes for our stakeholders fuels our drive to thrive through volatile circumstances. Though the pandemic is far from over and we are still in uncertain times, we look forward to a bright future as we join our fellow research centers to create One CGIAR.

Our novel product and process pipeline is now an extremely cohesive and coherent pathway to multiple products in the next few years due to the passion and perseverance of the staff at all levels. The successes at the horizon provide further impetus and in collaboration within One CGIAR we are in a strong position to deliver on our mandates of socioeconomic benefits to our stakeholders. We appreciate the continued support from our Partners & Investors as we gear up for this new and exciting era.


Dr. Ajay Kohli
Director for Research



RICE BREEDING INNOVATIONS

“Operating in a restrained environment, where lockdowns are being implemented at certain periods, poses many challenges, especially in our day-to-day work commitments. However, we remain dedicated to our goal of delivering the best products for our stakeholders and this has been demonstrated as we maintain operational excellence and cost-effectiveness in our activities. The platform, while maintaining a strict skeletal workforce, has remained flexible and strategic towards these work restrictions from the laboratories to the screen houses and from genetic screening to seed processing.”

DR. HANS BHARDWAJ
PLATFORM LEADER, RICE
BREEDING INNOVATIONS



**THE DRIVE TO PUSH RICE
SCIENCE TO THE EDGE**



The COVID-19 pandemic has exacerbated unemployment and hunger all around the world. 2021 saw us needing to be further involved in helping our farmers provide nutritious and sufficient food, especially through a time when health, food security, and livelihood of the population are threatened. This challenge remains our guide in creating strategies for the Rice Breeding Innovations Platform.

Operating in a restrained environment, where lockdowns are being implemented at certain periods, posed many challenges, especially in our day-to-day work commitments. However, we remain dedicated to our goal of delivering the best products for our stakeholders - and this has been demonstrated as we maintain operational excellence and cost-effectiveness in our activities. The platform, while maintaining a strict skeletal workforce, has remained flexible and strategic towards these work restrictions from the laboratories to the screen houses, and from genetic screening to seed processing.

As we enter another year of uncertainty, one thing is clear: our goal is to continue our efforts in the development and deployment of breeding strategies, tools, and technologies that are responsive to the challenges of climate change, food security, and scarce resources through the use of genetic resources. Specifically in 2022, we aim to complete the deployment of major genetic materials, launch hybrid rice in Nepal, and pilot the arsenic-safe rice project, among many other projects that are in our platform's pipeline.

These efforts, we hope, will not only be widely used in the regions where they are needed the most but will facilitate the recognition of rice germplasm as an important contributor to improving the lives of our farmers and consumers all around the world.

MISSIONS ACCOMPLISHED

Native trait resistance gene deployment

Incorporating genetic resistance into new crop varieties as a line of defense against plant pests and diseases is an important part of a breeding program. The advancements in molecular breeding methods have made it possible to utilize diverse sources of resistance genes.

Rice breeders at IRRI have been continuously searching for new sources of important resistance genes as part of the institute's breeding strategies to achieve more

durability of resistance in rice varieties to long-standing and emerging pests and pathogens as well as harsher environments caused by the climate crisis.

The deployment of rice yellow mottle virus (RYMV) resistance genes from African rice (*Oryza glaberrima*) has been completed. This represents the first time the RYMV genes have been available in an elite background in modern breeding programs. RYMV is a major disease of rice in Africa and these genes will be essential to achieving the continent's food security targets.

The deployment and pyramiding of major blast and bacterial leaf blight resistance genes have been completed. This is also the first time these genes have been available in elite genomic backgrounds and, together as a pyramid, will help ensure robust resistance to diseases.

Rice is very sensitive to salinity stress, particularly at the early vegetative and reproductive stages. In rice production, salinity is the second most damaging environmental stress. In salt-affected agricultural lands, approximately 1 billion hectares around the world, rice yield is seriously affected with losses that may reach as much as 50%. A major QTL for vegetative stage salinity tolerance in an elite background has been verified and this discovery could significantly simplify the breeding for salinity tolerance in rice.

New japonica rice shows promise of higher income for Filipino farmers

Filipino farmers have the opportunity to tap the premium rice market and earn higher income based on successful field trials of new japonica rice varieties developed by the Germplasm Utilization Value Added (GUVA) Project for tropical countries.



Field trials at IRRI and the Philippine Rice Research Institute (PhilRice) showed that Japonica 7, the most recent variety developed by GUVA, produced 7 tons/hectare (t/ha), higher than some high-yielding indica varieties. In farmer participatory varietal selection conducted in Tarlac Province, Japonica 7 produced 4.7 t/ha, the highest among the GUVA japonica varieties tested.

GUVA japonica varieties also required less phosphorus and potassium than indica varieties. Additionally, most of the japonica varieties developed by GUVA exhibited intermediate resistance to certain diseases such as blast and bacterial leaf blight and insect pests such as stem borer and brown planthopper.

Preliminary market studies have shown that japonica rice can command much higher prices than other Philippine premium varieties.

NEW COLLABORATIONS

Accelerating the impact of new rice varieties

Attaining food security does not end with developing new rice varieties that are high-yielding, tougher against pests and diseases, and more resilient to the impacts of climate change. New varieties must also reach farmers as quickly as possible.

The Network for Accelerated Rice Variety Impact (NARVI), a new membership-based elite germplasm sharing network for the private sector, was created in 2021 to speed up the transfer of technologies through IRRI-led multi-sectoral consortia that collaborate and network on key research and development areas.

The partnership program enables its 14 member companies to test new IRRI elite inbred rice for breeding in various countries. Each member receives access to 20 new elite inbred lines each year. Additionally, a user-friendly commercial licensing of the elite varieties will make it simpler for SMEs to develop and sell new varieties directly to farmers where the companies are based.

NARVI will support the goals of IRRI and CGIAR of a data-driven variety release and ensure improved varieties will also reach the farmers.

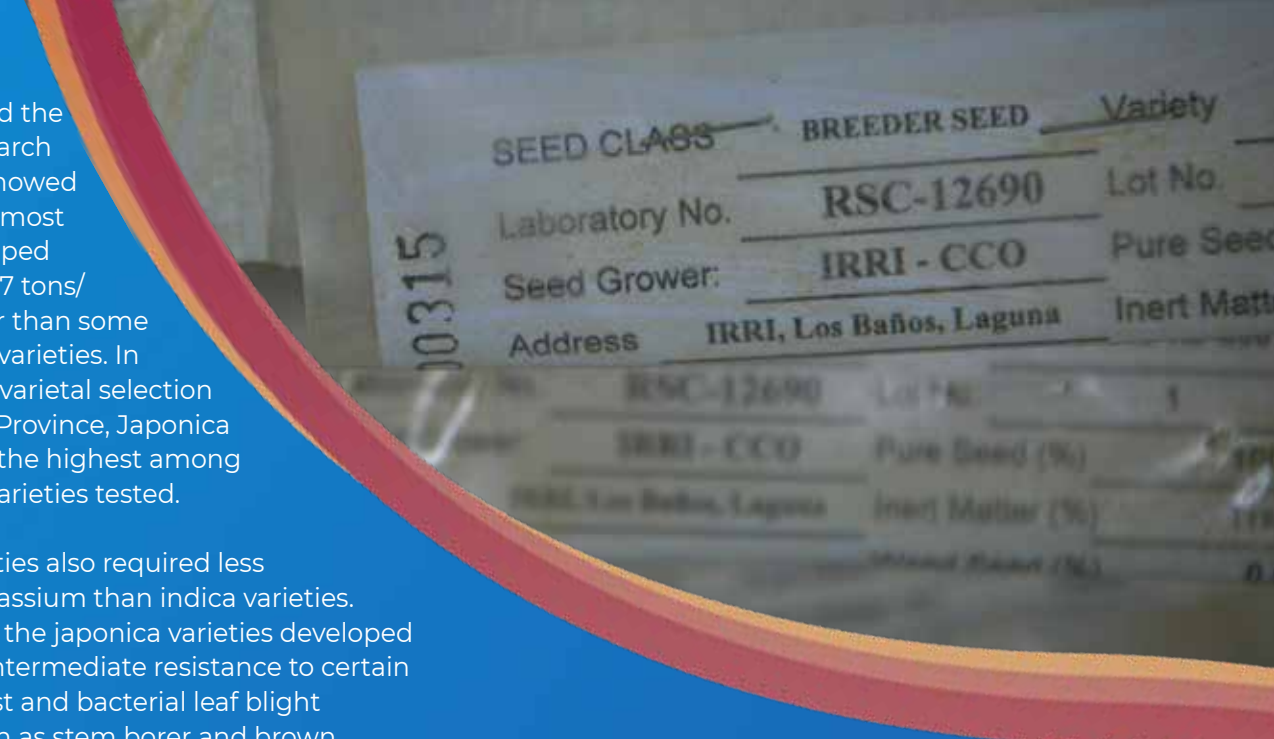
Achieving food security in Nepal through hybrid rice technology

Nepal's food security depends on the production of rice which is the country's primary staple cereal crop. Rice is grown on almost 1.5 million hectares in Nepal with average productivity of 3.5 tons per hectare. To meet local demand, Nepal imports rice.

Theoretically, rice still has a great yield potential to be tapped and there are several ways to increase rice yield. Based on successful experiences in China, the most effective and economical means is by developing hybrid rice.

If half of the rice-growing areas in the world are replaced with hybrid rice varieties with a 2 tons per hectare yield advantage, it is estimated that total global rice production would increase by another 150 million tons annually, according to the late Longping Yuan, the father of hybrid rice. This could feed 400–500 million more people each year. This would truly be a significant contribution to ensuring food security and peace all over the world, Prof. Yuan added.

Nepal is focusing on reducing its rice importation by increasing domestic rice production. To this end, the Nepal Government and IRRI launched the project, Achieving Rice Self-sufficiency in Nepal through Systematic Development and Use of Hybrid Technology on 16 July 2021.



Linking IRRI's valuable upstream discovery research with breeding pipelines

In 2021, we held a series of *Trait Advancement Workshops* with the aim of linking IRRI's valuable upstream discovery research with breeding pipelines. All trait scientists shared their ongoing work, which includes pathology, grain quality, nutrition, and physiology.

Each trait was "mapped" to the Trait Development Pipeline. The Trait Development Pipeline is a framework that provides clear guidelines for taking the next steps in our work on the identification of key traits/genes/QTLs that are needed by rice farmers and consumers.

The workshop involved fruitful discussions on the myriad ways that discovery research can contribute to breeding, from identifying new sources of stress resistance to helping breeders prioritize which breeding lines to use in their crossing work.

By better designing our discovery experiments, the Trait Development Pipeline is helping us become more efficient in generating research outputs that lead to impact. The strategy laid out in IRRI's Trait Development Pipeline is now used as an example across the CG system. It promises to increase the efficiency and impact of upstream work across multiple crop species.

Dr. John Damien Platten

Breeding Innovations and Informatics Research Unit Leader

Dr. Amelia Henry

Stress Physiology and Research Unit Leader
Traits for Challenged Environments

RESEARCH MILESTONES

Discovery of traditional rice varieties with strong anti-cancer properties

A team of researchers, headed by Dr. Nese Sreenivasulu from IRRI, in collaboration with Dr. Alisdair Fernie and Dr. Yariv Brotman from the Max Planck Institute of Molecular Plant Physiology, and Dr. Glenn Oyong from De La Salle University, looked into the identification of traditional rice varieties harboring the genetic basis of natural variation in secondary metabolites and their vital role in human nutrition.

The study, *The genetics underlying metabolic signatures in a brown rice diversity panel and their*

vital role in human nutrition published in *The Plant Journal*, found rare traditional rice varieties with the genetic traits of higher catechin levels, elevated total flavonoid contents, heightened antioxidant activity in the whole grain, and exhibiting anti-cancer properties. In addition, the genetic variations were also linked to a low glycemic index, which is ideal for rice consumers with type II diabetes.

Although the importance of brown rice as a nutritionally dense food staple has long been established, the study now provides genetic links to the production of plant metabolites important to human health.

A breeding breakthrough for rice varieties with extremely low glycemic index

Rice breeders aiming to develop rice varieties with a very low glycemic index (GI) are now closer to that reality with the important scientific breakthrough on lowering GI in high-yielding varieties,

Published in *Plant Biotechnology Journal*, the study, *OsTPR boosts the superior grains through increase in upper secondary rachis branches without incurring a grain quality penalty*, found a way to increase the yield of a rice mutant with an extremely low GI.

By combining a low-GI trait mediated by the mutation in starch branching enzyme IIb with a superior haplotype of *OsTPR* increases the upper secondary rachis branches of the rice plant which increases superior grain production.

"We were able to overcome the yield barrier of an extremely low-GI mutant by developing recombinant inbred lines (RILs) in the Samba Mahsuri background," said Dr. Nese Sreenivasulu, "These superior RILs exhibit optimum yield with an extremely low GI of 38, while many of the popular varieties of rice are high-GI in nature ranging from 70-92."

Initial peer-reviewed publications of Golden Rice biosafety data completed

The first series of peer-reviewed publications on the GR2E Golden Rice field trial data are now available in *Nature Scientific Reports* and *Frontiers in Plant Science* journals. These articles focus on the agronomic performance of Golden Rice varieties developed in the Philippines and Bangladesh.

These publications were authored by scientists and researchers of the Healthier Rice Program at IRRI, in collaboration with colleagues at the Department of

Agriculture-Philippine Rice Research Institute and Bangladesh Rice Research Institute.

Key findings indicate that agronomy, yield, and grain qualities are comparable to the conventional inbred rice counterparts: IR64, PSBRc82, and BRR1 dhan

29. Data show that the Golden Rice breeding lines developed in the genetic backgrounds of different local varieties contain enough beta-carotene to provide more than the 30% estimated average requirement for vitamin A in young children.



2021

YEAR IN REVIEW



5
Projects and activities completed



23
New research collaborations



33
Published works in peer-reviewed publications

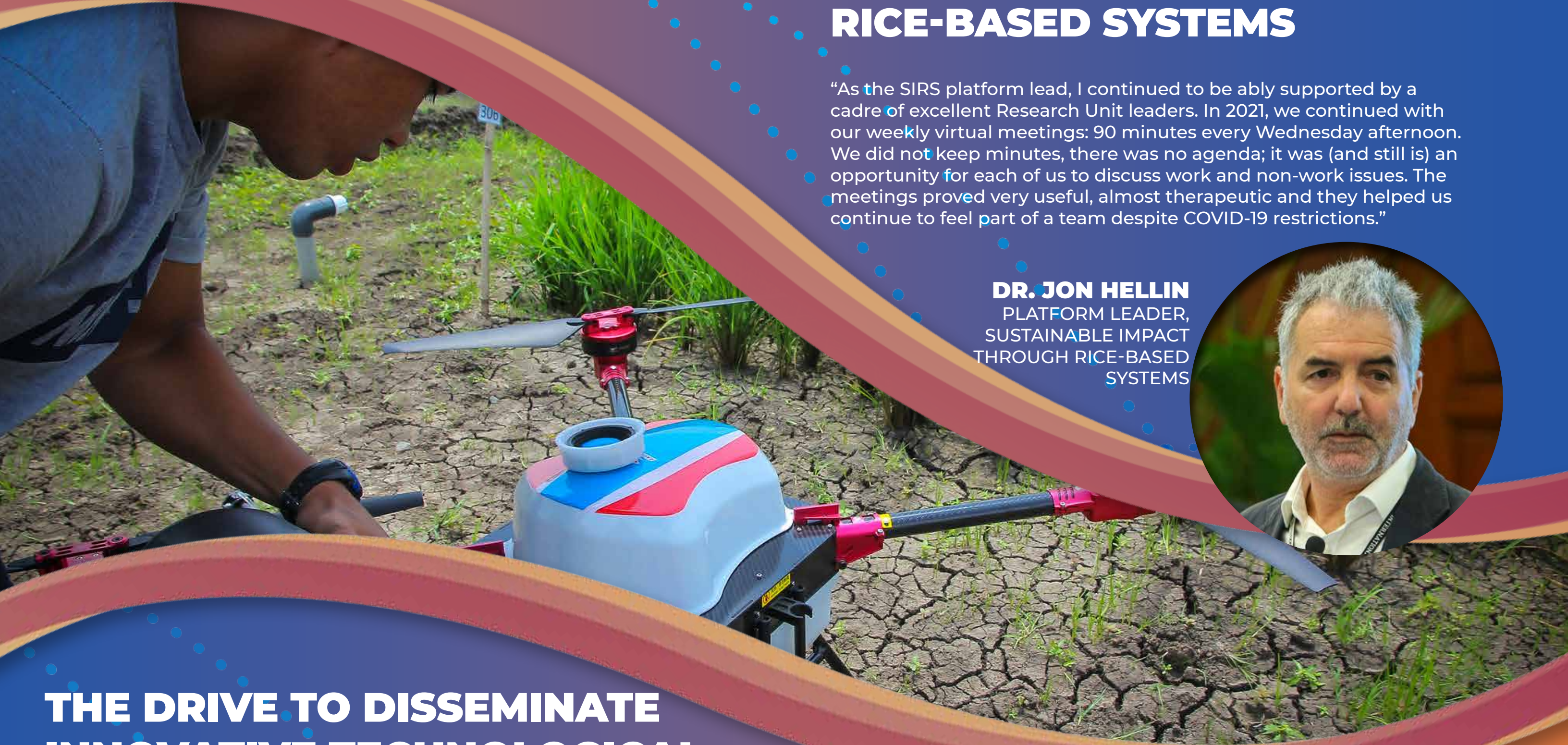
SUSTAINABLE IMPACT THROUGH RICE-BASED SYSTEMS

“As the SIRS platform lead, I continued to be ably supported by a cadre of excellent Research Unit leaders. In 2021, we continued with our weekly virtual meetings: 90 minutes every Wednesday afternoon. We did not keep minutes, there was no agenda; it was (and still is) an opportunity for each of us to discuss work and non-work issues. The meetings proved very useful, almost therapeutic and they helped us continue to feel part of a team despite COVID-19 restrictions.”

DR. JON HELLIN
PLATFORM LEADER,
SUSTAINABLE IMPACT
THROUGH RICE-BASED
SYSTEMS



**THE DRIVE TO DISSEMINATE
INNOVATIVE TECHNOLOGICAL
INTERVENTIONS**



Like many, I breathed a sigh of relief on 1 January 2021, convinced that the worst of the COVID-19 pandemic was behind us and that things could only get better. My optimism proved to be a little misplaced but, at the same time, and despite the on-going challenges posed by COVID-19, things did get better.

As SIRS platform lead, I continued to be ably supported by a cadre of excellent Research Unit leaders. In 2021, we continued with our weekly virtual meetings: 90 minutes every Wednesday afternoon. We did not keep minutes, there was no agenda; it was (and still is) an opportunity for each of us to discuss work and non-work issues. The meetings proved very useful, almost therapeutic and they helped us continue to feel part of a team despite COVID-19 restrictions.

One of the biggest challenges as the platform lead was the absence of face-to-face meetings, not just with the Research Unit leaders but with the wider staff. Just prior to COVID-19 lockdowns in March 2020, I had visited ISARC in Varanasi, Uttar Pradesh, India for the second time and also IRRI's excellent work in Assam. I was looking forward to more of these sorts of visits in 2021. They never materialized.

Another challenge was the uncertainties around the changes in CGIAR, and the often exhausting demands that I and others faced as we developed proposals from April onwards for the Initiatives under the reforming CGIAR.

There were many positives though; ones that have positioned SIRS and

IRRI in general well for the future. The initiative design process brought together scientists from IRRI as well as across and beyond the CGIAR in conceptualizing and, from 2022, implementing exciting inter- and transdisciplinary research-for-development projects. I believe that this will pay big dividends in the months and years to come as it addresses the different ways that we as scientists need to work in order to ensure that our work has a greater impact.

CGIAR is not alone in recognizing that for our research to have more impact we need to embrace the reality that while innovative technological interventions are critical, enabling social, institutional, and governance factors provide the context within which change happens. This in no way undermines the excellent science that SIRS scientists and others do on a daily basis, it just means that projects give more attention (as SIRS scientists have done through their work on the Initiatives) to science and also partnerships, capacity building, governance, and policy.

By doing so, CGIAR research will have more impact. For a platform whose remit is "sustainable impact" this is a very pleasing way to end 2021 and look forward to great achievements in 2022.

MISSIONS ACCOMPLISHED

Bringing precision technology for rice production to the field

IRRI and the Bureau of Agricultural and Fisheries Engineering of the Philippine Department of Agriculture concluded the project *Laser Land Leveling for Land Use Efficiency in the Philippines* in a virtual meeting in June 2021. The one-year project was launched to enhance the capacity of laser land leveling operation and management and increase the effectiveness of the technology.

The project implemented multiple training activities and seminars on the use of laser land leveling equipment attended by more than 2,000 stakeholders, including government officials, researchers, and farmers.

In 1997, IRRI in collaboration with Trimble (then Spectra Precision) introduced laser land leveling technology to stabilize rice production and improve efficiency in field operations. Today, it is used by thousands of farmers in rice-growing economies to reduce farm inputs and water usage, while improving their yields. The technology saves more than 20% of irrigation water, reduces stagnant water, and helps increase the



This project serves as a model of how science can be translated into results through access to science, and evidence-based information using technology-supported platforms.

The Philippines becomes the first country to approve "Golden Rice" for commercial production

Filipino farmers will become the first in the world to be able to grow a variety of rice enriched with nutrients to help reduce childhood malnutrition, after receiving the green light from regulators. The Philippine Rice Research Institute developed Golden Rice in partnership with IRRI to contain additional levels of beta-carotene, which the body converts into vitamin A.

This new variety has already received food safety approvals from regulators in Australia, New Zealand, Canada, and the US and is currently undergoing final regulatory review in Bangladesh.

But the Philippines is the first country to approve its commercial cultivation. This milestone puts the Philippines at the global forefront in leveraging agriculture research to address the issues of malnutrition and related health impacts in a safe and sustainable way.

efficiency of input use like fertilizers and herbicides, thus reducing greenhouse gas emissions.

Translating science into accessible evidence-based information

IRRI formally transitioned Rice Crop Manager Advisory Service (RCM) Philippines to the Philippine Department of Agriculture (DA). RCM Philippines is a major digital agricultural product that is a result of the partnership between IRRI and the DA, which includes intensive collaborations and research work on crop research, product development, and extension services.

IRRI, DA, and the Philippine Rice Research Institute launched RCM in 2013 to offer customized guidance to farmers on nutrient and crop-specific management. To date, over 2.6 million RCM recommendations have been generated in 16 rice-growing regions throughout the Philippines. The average yield increase of 0.4 tons per crop per hectare resulted from the use of RCM recommendations, which is equivalent to approximately USD100/ha/cropping season added net benefit over conventional practices.

Zooming in on science-based solutions

The Council for Partnership on Rice Research in Asia (CORRA) hosted an online science webinar, *Rice Straw Management: Scaling GHG Emission-Reducing Technologies and Practices*, that presented different options for repurposing the rice byproduct, as an alternative to the practice of rice straw burning.

Every year, over 600 million tons of rice straw are produced after rice harvesting globally. In South and Southeast Asia, the traditional practice of many rice farmers, especially poor smallholders, has been to burn the rice straw in the field in order to clear the paddy quickly for the next planting.

However, studies on rice straw burning have shown that this practice is harmful, as it produces high GHG emissions and particulates hazardous to human health. Rice straw burning also causes nutrient and biodiversity losses in the soil, which affect the long-term sustainability of rice fields.

NEW PARTNERSHIPS

Building a database of knowledge gained and lessons learned

Closing Rice Yield Gaps in Asia with Reduced Environmental Footprint Project (CORIGAP) aims to improve food security, promote gender, equity, and reduce poverty by optimizing the productivity and sustainability of irrigated rice production systems in six Asian countries.

CORIGAP has completed two phases, spanning seven years, promoting best management practices for lowland intensive rice production in China, Myanmar, Thailand, Vietnam, Indonesia, and Sri Lanka. The project has reached more than 600,000 farmers and about 118,000 farmers have adopted the best practices and increased their rice yield by 11–20% and profits by 15–25%.

CORIGAP Phase 3, which started in 2021, builds on the tremendous impact of the preceding phases. CORIGAP 3 will document and disseminate the learnings, outputs, and outcomes to different audiences to ensure that these are taken up by other projects and policymakers. It also aims to design pathways for the agroecological transition toward sustainable food systems.

By developing and disseminating knowledge products for project partners, development partners, policymakers, and donors CORIGAP's successful

activities can be replicated in other projects and regions.

A digital library is now available on the project website (<https://corigap.irri.org>) to expedite the public's access to publications and knowledge products of CORIGAP and the Irrigated Rice Research Consortium. The digital library aggregates scientific journal articles, book chapters, magazine features, news archives, and more resources, which can be located through the searchable database. All articles can be downloaded or retrieved through direct links.

Climate-smart rice-based systems to play a crucial role in agriculture in Odisha, India

A newly launched project will work with smallholder women and men farmers in three districts in Odisha to promote the diversification of rice-based systems as a way of enhancing climate and livelihoods resilience. The three-year project, *Climate Smart Rice-based Systems for Prosperity and Resilience in Odisha* (ClimatePRO), is a collaborative effort of IRRI and the Government of Odisha.

ClimatePRO aims to intensify and diversify agricultural production in Ganjam, Mayurbhanj, and Bolangir to support smallholder farmers in building their resilience and capacity to adapt to climate change stresses affecting agricultural production. Climate-resilient and high-yielding rice varieties followed by pulses, oilseeds, and other high-value crops in conjunction with climate-smart agricultural practices will be promoted to improve incomes and contribute to the sustainable intensification of farming systems in the state. The formal and informal seed systems will be strengthened to enable crop diversification.

A major component of the project is promoting women farmer entrepreneurship. A multi-product multi-service women's Farmer Producer Company (FPC) will be incubated in Bolangir following the successful model in Kalahandi. The FPC and selected Farmer Producer Organizations in the three districts will be supported to engage in quality seed production and marketing.

India's premium black rice varieties get a boost in Assam

IRRI and the Government of Assam have begun production of new black rice varieties from across India under the World Bank-funded *Assam Agribusiness and Rural Transformation project* (APART). Under the project, IRRI will provide seeds of Manipuri, Kalamalifula, and Kalavati to selected farmers in Goalpara District for sowing.

The demonstration fields aim to link the farmers with the buyers for higher returns and make good quality seed available for future use. With the growing demand for black rice due to its high nutritional value and health benefits, APART aims to increase black rice production in the state.

Working together for faster, more efficient, and cleaner rice agriculture

SIRS continuously identifies strategic research to meet current and future needs and opportunities amongst IRRI scientists and partners and maps out plausible impact pathways leading to outcomes and impact. In 2021, among the platform's new collaborations

in key research areas are mechanization, postharvest management, rice straw management, and low carbon rice with Vietnam's Loc Troi Group, mechanized direct seeding with APV Austria, and agritech, mechanization, and precision farming with DLG Germany.





engagement strategy has been limited because of the restrictions imposed by the COVID-19 pandemic on travels. In many cases, face-to-face engagements were replaced by online meetings, which do not always allow capturing all information necessary for policy development. This was compensated by documentation and literature reviews.

Formulating food security policies for the rapidly evolving global agri-food systems

IRRI plays a major role in the development of food security policies through its excellence in rice research and global engagement. With decades of excellence in rice research, IRRI has been able to capitalize a body of evidence to support the formulation of several food security policies in the rice-based agri-food system. However, as we engage with the CGIAR unification and continue to battle the COVID-19 pandemic, several challenges presented themselves in the way we fulfill that role.

Developing food security policies requires engagement with stakeholders to discuss and receive feedback on the pieces of research evidence on which the policies are formulated. But since 2020, our country

The COVID-19 pandemic negatively impacted both supply and demand sides of the agri-food value chains. The challenges on the supply side include reduced availability and higher cost of labor, material inputs, and agro-advisory services; disruption in the input and output supply chains; and decreased market access and low prices for agricultural outputs. The challenges on the demand side include: reduced income and employment opportunities, decreased availability of food items, and a shift in consumption partners towards cheap and less nutritious foods, especially for the poor. In response we are directing our efforts on developing future food security policies focusing on increasing yield, promoting labor-saving technologies and digital tools in agriculture, strategies to make supply chains function more effectively, collective

actions in farming, nutrition-sensitive agriculture, and creating social safety nets.

The COVID-19 pandemic has negatively affected the partnership among different stakeholders and the implementation of some research activities. This has had negative effects on the generation of new technologies and innovations to improve food security. From a research standpoint, some methodological challenges also exist. The IRRI Global Rice Model (IGRM) focuses on rice production, trade, and prices over the longer term (2030+). The IGRM can be used to examine major drivers such as changes in technology, income, population, and climate at the global and regional scales. We are enhancing this by aligning and linking with other global socioeconomic models like the IMPACT model of IFPRI. Model improvements could include harmonizing model data sources, as well as identifying linkages and complementarities between IGRM and IMPACT. For example, these two analytical tools can be brought together by linking IGRM to the water and land systems components that are already in the IMPACT model.

To develop relevant policies to support the agri-food system transformation, evidence should be provided through solid and rigorous models and analysis. Prior to the One CGIAR initiative, data collection for socioeconomic research and modeling has mostly focused on rice-related information. One of the challenges

IRRI is working on is establishing a data collection system that goes beyond the traditional rice-based systems information, but includes other commodities and expands to new areas such as livestock, fish, poultry, etc.

The agri-food systems have been rapidly evolving around the world and different countries are at different stages of this transformation. Formulating food security policies in the regions and countries of interest will require engagement with key stakeholders of interest. As we engage with the CGIAR unification, identifying and collaborating with unfamiliar or non-traditional stakeholders may be challenging. IRRI plans to establish new public-private partnerships to support this global agri-food system transformation.



Dr. Valerien Pede
Head, Impact Evaluation, Policy & Foresighting Unit

2021
YEAR IN REVIEW

3
Projects completed

2
Research collaborations

1
New research collaboration

21
Published works in peer-reviewed publications

IRRI EDUCATION

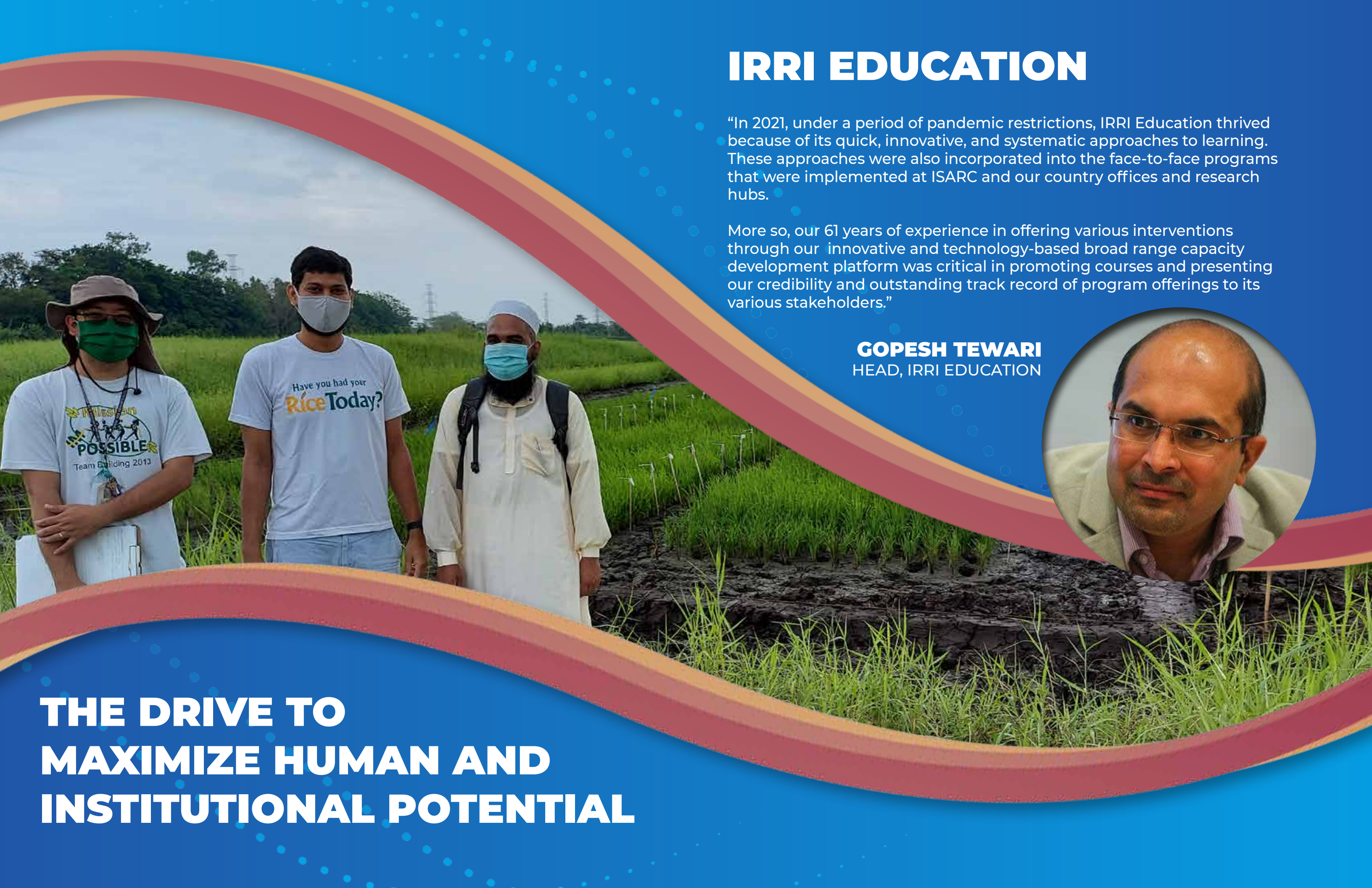
“In 2021, under a period of pandemic restrictions, IRRI Education thrived because of its quick, innovative, and systematic approaches to learning. These approaches were also incorporated into the face-to-face programs that were implemented at ISARC and our country offices and research hubs.

More so, our 61 years of experience in offering various interventions through our innovative and technology-based broad range capacity development platform was critical in promoting courses and presenting our credibility and outstanding track record of program offerings to its various stakeholders.”

GOPESH TEWARI
HEAD, IRRI EDUCATION



**THE DRIVE TO
MAXIMIZE HUMAN AND
INSTITUTIONAL POTENTIAL**





Despite the challenges and restricted mobility caused by the COVID-19 pandemic, IRRI Education successfully reached individual, institutional, and system-level stakeholders through its innovative and technology-based broad range capacity development (CapDev) platform. CapDev enabled IRRI Education to implement customized, demand-driven, and relevant courses co-designed and delivered by globally renowned academicians, researchers, and field experts.

We were able to smoothly adapt by reviewing and redesigning our training approaches for participant-friendly online and digital tools and maintain a dedicated learning management system for the New Normal classroom. We made urgent efforts to bring the classroom experience to the online sessions through queries, discussions, simulations, case studies and analysis, and assessment and feedback sessions.

We duly monitored and recorded the responses of our participants through online tools and platforms to help us maintain the discipline and keenness among the participants towards the sessions and resource persons.

At the same time, we used a project monitoring tool to track our staff's duties, progress, and deliverables

and organized workshops to enhance the skill sets of our people involved in the development, facilitation, and implementation of the different online and face-to-face learning offerings. Our robust monitoring and evaluation process ensured getting accurate feedback on the quality of the various programs we implemented and the measurement of learning outcomes of our participants.

Through CapDev our trainees in the agriculture sector were able to participate better and learn skills, knowledge, and values that would enable them to meaningfully contribute to their communities at the local, national, and international levels.

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2021 YEAR IN REVIEW



Courses and trainings hosted



Trainees, students, and scholars reached

Geographical locations of our participants

- | | |
|--------------|----------------|
| Bangladesh | Myanmar |
| Benin | Nepal |
| Bhutan | Nigeria |
| Brazil | Pakistan |
| Burkina Faso | Philippines |
| Burundi | Senegal |
| Cambodia | South Korea |
| DR Congo | Sri Lanka |
| Germany | Switzerland |
| Ghana | Taiwan, China |
| India | Tanzania |
| Indonesia | Thailand |
| Iran | Uganda |
| Italy | United Kingdom |
| Ivory Coast | USA |
| Kenya | Vietnam |
| Lao PDR | |
| Mali | |
| Mozambique | |



Online learning

Following its plan of action of reaching more people and making learning accessible despite distance and other restrictive limitations, IRRI Education developed self-paced e-learning modules. These modules allowed participants to learn in their own time and schedule at any pace. Self-paced learning comes with several advantages that can enhance the performance of the learners. In addition, more than 10 micro modules have been developed and made available on our learning management system in 2021. These have been published through IRRI Education's social media platforms and will be included in IRRI's Rice Knowledge Bank in 2022.

Scholars and youth engagement

Eighty six scholars from 18 countries have been hosted for their internship, on-job training, and research as part of their undergraduate and post-graduate (MS and PhD) programs. These students were able to experience learning in a cross-cultural environment, conducting of their training and research under the supervision of world-renowned experts while having full access to state-of-the-art facilities with support from various donors and agencies.

40%
Percentage of women attended the courses

Knowledge Platform: Overcoming language barriers

On 24 February, the English and Assamese versions of the Rice Knowledge Bank (RKB) (www.rkbassam.in) were launched by Shri. Rajesh Prasad, IAS, Principal Secretary to the Govt. of Assam, Agriculture Department, and Agriculture Production Commissioner, Assam. Currently, the website is available in English, Assamese, Bengali, and Bodo. Simultaneously, a mobile app version of RKB was created keeping in mind that India is moving towards a more digitized outlook. The RKB can be downloaded to any Android phone from Google Play store. Moreover, several brochures and booklets have been published in Assamese and distributed to bridge the gap between technology and the farmers. These extension materials include topics such as stress-tolerant rice varieties, quality seed production, direct-seeded rice, commercial production of certified seed, seed certification, weed management, and postharvest implements

INTEGRATIVE RESEARCH SUPPORT PLATFORM

“At the start of the pandemic lockdown, when almost no one was allowed on-site, we made full use of the opportunity to conduct online continuous improvement training in collaboration with the Excellence in Breeding platform of CGIAR. We innovated and pushed through and managed to solve several service issues including creating land preparation packages that are more inclusive to the needs of researchers, developing a program improving the land soil health, and facilitating discussions between IRRI’s Finance Department and laboratories to improve their service provisions and recoveries.”

**DR. SHARIFAH SHAHRUL
RABIAH SYED ALWEE**
PLATFORM LEADER, INTEGRATIVE
RESEARCH SUPPORT



THE DRIVE TO OPTIMIZE OPERATIONAL EFFICIENCY

As the IRSP lead, my main task is to ensure the platform delivers research support effectively and efficiently. This task was made even more challenging when only six months into my job, IRRI closed down due to COVID-19 and everybody had to work from home.

As research activities did not really slow down because of the pandemic, the challenge was how do we equip the team with the right tools to be professional service providers and do our job when more than half of our service team members are working from home? I am encouraged by the fact that my team has the experiences needed to support IRRI's researchers.

At the start of the pandemic lockdown, when almost no one was allowed on-site, we made full use of the opportunity to conduct online continuous improvement training in collaboration with the Excellence in Breeding platform of CGIAR. We innovated and pushed through and managed to solve several service issues including creating land preparation packages that are more inclusive to the needs of researchers, developing a program improving the land soil health, and facilitating discussions between IRRI's Finance Department and laboratories to improve their service provisions and recoveries.

What is more important is that we removed the cluster barrier so people can effectively work cross-functionally. This is now how IRSP works. Continuous improvement is our mantra and every year a new batch of trainees are "recruited" to work on simple but high-impact problems that contribute toward improving research services in support of all research needs in IRRI.

As quality research delivery is key, IRSP developed a quality management system (QMS) to ensure all research supports and services follow a standardized process. Through the QMS process, we constantly strive for process improvements and a professional system to review our work based on customer feedback.

After almost two years of working fully online to train our team, we have created a system to receive service requests and assess demands from the researchers, hence establishing forecasting tools for us to plan our resources.

Improved efficiency can be achieved with the activity consolidation that we are now conducting with Rice Breeding Innovations. Through this effort, we will finally truly have an integrated research support and

service platform in IRRI that will drive better research deliveries and outputs.

The bottom line is no matter what challenges come our way, we need to remain connected, supporting one another. Challenges and shortcomings are everywhere but if we continue to focus on the job at hand, we will succeed.

MISSIONS ACCOMPLISHED

The biggest room in the world is the room for improvement

The Zeigler Experiment Station (ZES) provides professional farm management services, mechanization and postharvest, and training provision for on-field research support. Through the ZES Quality Management System (QMS), the platform is committed to achieving and maintaining a high standard of quality in all aspects of the delivery of its services and support within IRRI and across the global IRRI network. The target is to achieve at least an 85% satisfaction rating from clients/partners and 90% annual recovery of costs. By partnering with key stakeholders, IRSP identifies issues in our services and operations, proposes solutions, and implements improvements.

IRSP provided assistance to the IRRI-South Asia Regional Centre (ISARC) staff in setting up and implementing the center's full cost recovery system for land, irrigation, and farm equipment rentals in its headquarters in Varanasi. The FCR will further strengthen the sustainability of ISARC.

Excellence is a continuous process of initiatives, effort, smart direction, and meticulous execution

The IRRI Service Laboratories are an ISO/IEC 17025 accredited cluster of laboratories that provide solutions to testing and instrument support services needs of the research and agricultural industry.

With more than 70 test parameters for rice grain, plant, and soil matrices, the Genotyping Services Laboratory (GSL) and Grain Quality and



Nutrition Services Laboratory (GQNSL) are committed to developing and offering quality work by maintaining their compliance with local and international standards.

The continuous ISO/IEC 17025 accreditation of GSL and GQNSL provides assurance of the reliability of our test results, provision of quality customer services through its competent staff, and continuous improvement in its quality management system.

A collaborative effort and strategy to achieve volume forecasting of the laboratories' requirements from IRRI projects were implemented to effectively plan for the procurement of resources required to deliver quality services, and maintain lab operations under full cost recovery.

Business process improvement and the potential outcome of the change

IRSP successfully completed the modernization and integration of the International Rice Genebank activities.

The Smartsheet Request Logbook, linked to the GSL Service Planner, provides staff with rapid access to details of individual requests for sample-related information, vendor, Seed Health Unit, shipment-related specifics, and tasks assigned to each team member. The automated reminders and notifications for succeeding steps in the workflow are also integrated into the logbook to streamline the requests process workflow.

The platform helped establish the Grain Quality Laboratory at IRRI Bangladesh. The technical online support included the procurement of essential equipment and instruments and the renovation of the facility for the state-of-the-art analysis of various economically relevant grain quality traits and in addition nutrition value from pre-breeding and breeding materials.

IRSP provided its expertise online to help the Centre for Excellence in Rice Value Addition (CERVA) meet the general requirements for the competence, impartiality, and consistent operation of laboratories to get its ISO/IEC 17025 Accreditation. The platform also provided online support for the laboratory's service operations and FCR implementation. These process improvements show beyond doubt CERVA's capacity to operate competently, generate valid results, and take its place as one of the top-notch laboratories nationally, regionally, and around the world.

The platform supported ISARC establishing the Speed Breeding Facility. Speed breeding is an emerging strategy among plant breeders to speed up varietal development through advanced technologies and protocols.

Success requires learning as fast as the world is changing

IRSP launched an initiative to develop, train, and prepare our core teams tasked with teaching and developing an innovative mindset and culture, strong problem-solving skills, and the desire to make breeding operations and strategies better.

The Seed Health Unit upgraded its pathogen screening tests to enable the faster delivery of healthy materials compliant with international phytosanitary standards. Its operational manual was augmented to include a risk-based and continuous improvement approach. Thorough planning, regulatory and statutory requirements, and customer needs and expectations were considered in redesigning the standard operating procedures and technical protocols.

The new updated policy of the Stewardship Support expands the zone of influence from transgenics to other new breeding areas such as wild rice, native traits, and gene-editing tools. The unit also successfully passed the stewardship audit of the Direct Seeded Rice Project.

NEW COLLABORATIONS

Transforming rice science, innovation, and R&D landscape through public-private sector partnership

In June 2021, the institute launched the IRRI Bioinnovation Centre (IBC). IBC offers lab and office space, high-end equipment, scale-up facilities, technical support, and centralized research support and services to private companies and start-ups to support innovations, translate discovery to products, and nurture future technologies. Within one year of its establishment, five research centers have signed an MOU with IBC to carry out various types of research partnerships with IRRI.

A collaborative project between IRRI and BASF is paving the way toward a public-private research and development consortium for direct-seeded rice and the development of herbicide-tolerant rice varieties that can thrive in Asian agro-climatic conditions.



2021

YEAR IN REVIEW



5,707

Service requests accomplished



75%

Overall customer satisfaction



6

Continuous improvement projects completed



35

IRRI staff trained in LEAN continuous improvement methodology

THE DRIVE TO MEET COMMITMENTS AND CREATE NEW OPPORTUNITIES



“There was a decline in opportunities when the pandemic started in 2020 so we focused on developing funding through our existing network and sought opportunities for direct commissioned grants. Since then opportunities in many sectors have returned to normal and we have increased the quantity and quality of our bids through enhanced evaluation, leading to a much higher success rate in 2021.”

Alvin Poncin
Head, Portfolio Development and Management Office

NEW PARTNERSHIPS

Capacity-building for higher education and the establishment of Genome Agricultural Research Center at the University of the Philippines Los Baños

Korea International Cooperation Agency
Philippine Government

Climate smart rice-based systems for prosperity and resilience in Odisha

Government of Odisha

Closing Rice Yield Gaps in Asia Phase III - 2021-2022

Swiss Agency for Development and Cooperation

Evidence to achieve GENDER and One CGIAR Visions

International Livestock Research Institute – Kenya

Enterprise Breeding System B4R Phase II

International Maize and Wheat Improvement Center

Cereal Systems Initiative for South Asia Phase III (USAID component)

International Maize and Wheat Improvement Center

Reducing carbon emissions from rice-based systems in Indonesia

PT Nestle Indonesia

Transformative strategy for controlling rice disease in developing countries Phase II

Heinrich Heine University Dusseldorf
Bill & Melinda Gates Foundation

Crops to End Hunger

CGIAR, United States Agency for International Development, Bill & Melinda Gates Foundation, UK Department for International Development, German Federal Ministry for Economic Cooperation and Development, Australian Centre for International Agricultural Research

IRRI Excellence in Breeding - Mechanization to enable direct seeding in rice breeding operations

International Maize and Wheat Improvement Center

Linking genetic, genotypic and phenotypic data of biotic and abiotic stress tolerance for improved Taiwanese rice varieties

Council of Agriculture of the Republic of China (Taiwan)

PORTFOLIO DEVELOPMENT & MANAGEMENT OFFICE

2021
YEAR IN REVIEW



35

Grant agreements



22

General agreements



36

Contract amendments

THE DRIVE TO STAY CONNECTED

“Like any other year, 2021 started with a lot of challenges and uncertainties. But we remain positive that things will get better. With the support of IRRI’s researchers, scientists, and other support staff, A&B has been able to deliver communications and advocacy work that has highlighted IRRI’s valuable contributions to rice-based food systems around the world.”

Some of our achievements include engaging key decision-makers and policy influencers through high-level events and meetings such as the East Africa Rice Conference 2021, the UN Food Systems Summit, the COP26 side event on Locally Led Adaptation for Climate Change Resilience in Asian Mega-Deltas, and the Nutrition 4 Growth Summit.

Using traditional and social media platforms, we reached over 1 billion viewers per month.

We built the IRRI Design Lab to provide our partners with more effective and efficient services.



We launched A&B Engage to provide custom-made communications and events management support to our research programs.

We mobilized IRRI scientists to be brand ambassadors and contribute to thought leadership.

We are also happy to be the top-of-mind provider of communications expertise and support for IRRI and are proud to be recognized in the greater CGIAR as a go-to partner for communications, branding, and engagement. We have worked closely with CGIAR on a number of high-profile events and projects, including the ongoing One CGIAR transition where several of our staff have taken on leadership roles.

As we look forward to 2022, A&B will continue to work hard to raise awareness of IRRI’s work and its relevance to the global development agenda. We are committed to communicating the value of rice and food systems research in improving the lives of smallholder farmers and contributing to a more sustainable future for all.

Sherwin Pineda
Head, Advocacy & Brand



2021 YEAR IN REVIEW

ADVOCACY & BRAND



3,350
Media mentions



7,080
Social media reaches



443,200
Website visitors



110
Webinars hosted and supported

“In spite of the suddenness and protractedness of pandemic restrictions, we have maintained standards and risen to the challenges that ensure we and wider stakeholders within the institute continue to operate at and ideally above industry-level standards. To that end, we have introduced and adopted virtual recruiting technologies and approaches to mitigate the implication of ‘face-to-face’ challenges.”



Olawale Fajobi
 Director for Human Resources and Organizational Development
 Chief of Staff

THE DRIVE TO UPHOLD ABOVE-INDUSTRY STANDARDS

The well-being—both mentally and physically—of our staff and wider workforce continues to be paramount and sacrosanct. This is very important as they continue to deliver in their roles and responsibilities in a complex and challenging operating environment.

To that end the IRRI Human Resources and Organizational Development Team has introduced a number of tips, guidelines, initiatives, and more formal policies, to support, equip, and ultimately ameliorate staff’s experiences. Staff motivation and health-related concerns, anecdotally and formally fed back, were and remain an area of significant concern.

In the year to date, we have pivoted and adjusted several approaches and processes across the range of HR activity to ensure that client support and engagement remained connected, iteratively improved, and ultimately a vibrant experience.

The team continues to primarily work remotely from home with attendant communication and internet connection difficulties for most staff, primarily based in IRRI’s headquarters in the Philippines.

In spite of the suddenness and protractedness of pandemic restrictions, we have maintained standards and risen to the challenges that ensure we and wider stakeholders within the institute continue to operate at and ideally above industry-level standards. To that end, we have introduced and adopted virtual recruiting technologies and approaches to mitigate the implication of ‘face-to-face’ challenges.

We have also shifted our talent-attraction efforts to reach out to remote and highly sought-after world-class talent/potential candidates who may not necessarily be actively searching for new work. Alongside the above, and in tandem with our Learning and Development Framework launched in late 2020, we actively encourage and drive consideration of our highly talented internal staff pool for new/key positions as they arise.

Most importantly, we continue to explore new and novel ways to enable, equip and support the staff’s mental and physical wellbeing through our third-party healthcare partner and internally through new and smart ways of working and engagement.

HUMAN RESOURCES AND ORGANIZATIONAL DEVELOPMENT

2021

YEAR IN REVIEW



934

Number of staff at headquarters



42%

Percentage of women



35

Number of nationalities



48%

Percentage of staff working from home



97

Number of globally recruited staff



69

Number of new positions



65

Number of newly hired staff



5

Number of promotions

58
Nationally recruited

7
Globally recruited



56
Number of career advancements

THE DRIVE TO DELIVER IMPACT ACROSS THE WORLD

INDIAN PRIME MINISTER INAUGURATES IRRI'S SPEED BREEDING FACILITY

Prime Minister Narendra Modi inaugurated IRRI's state-of-the-art Speed Breeding (SpeedBreed) Facility on 23 December 2021 at ISARC in Varanasi.

Speed breeding is an emerging strategy among plant breeders to speed up varietal development through advanced technologies and protocols. This new facility,

established with support from the Department of Biotechnology and the Department of Agriculture and Farmers' Welfare, will accelerate the breeding of new crop varieties, which can help Indian farmers increase their incomes and be less vulnerable to climate change effects.



BANGLADESH RURAL DEVELOPMENT ACADEMY AND IRRI TRAIN WOMEN FARMERS TO BE SEED ENTREPRENEURS

The Rural Development Academy-Bogura in Bangladesh and IRRI organized a workshop that strengthens women farmers' knowledge on proper seed certification guidelines and seed quality control issues. Thirty women-led farmers groups attended the seed quality control and marketing workshop in Narchi Village, Shahjahanpur sub-district on 08 November 2021. The workshop is an initiative under OneRice, a unified rice breeding strategy to develop and deliver better rice varieties faster to the farmers in Africa and Asia.



REDUCING SOUTH ASIAN FARMERS' RISK THROUGH THE FLOOD-TOLERANT BINA DHAN-11



BINA Dhan-11 is an early-maturing, high-yielding, variety with short slender grain. It is a flood-tolerant variety developed and released through the Bangladesh Institute of Nuclear Agriculture (BINA) in 2013 under BINA Director General Mirza Mofazzal Islam. The collaboration between IRRI and its national research and extension systems partners has successfully introduced, tested, and scaled this climate-resilient product benefitting thousands of smallholder farmers in eastern India and Bangladesh.

CGIAR SUPPORTS TRANSPARENT, RESPONSIBLE, AND SUSTAINABLE FOOD SYSTEMS IN VIETNAM

IRRI joined Vietnam's Ministry of Agriculture, other CGIAR centers, international organizations, and the private sector in a series of dialogues ahead of the United Nations' Food System Summit in September 2021. The events bring together key people from state agencies, academia, NGOs, donor agencies, and industry to help address existing and emerging challenges and opportunities in Vietnam's agri-food systems and inform policies and investments. This event invited stakeholders to discuss and identify key issues and opportunities for Vietnam's food systems in the next decade, particularly under the UN's five Action Tracks:

- Access to safe and nutritious food for all
- Sustainable consumption patterns
- Sustainable food production at scale
- Competitive, inclusive, and equitable food value chains
- Resilience to vulnerabilities, shocks, and stress.



INCREASING PROSPERITY OF SMALL AND MARGINAL FARMERS CALLS FOR STRONG RESEARCH COLLABORATION

A strong collaboration between IRRI and its national agricultural research and extension system partners is crucial to increasing the prosperity of small and marginal farmers through the proliferation of rice science, according to ISARC Director Sudhanshu Singh. Dr. Singh made the statement on 19 June 2021 during the online Review and Planning Workshop of the project *Climate-Smart Management Practices and the Climate-smart Management for the Stress-prone Environment* sub-project under the Indian Council of Agricultural Research -IRRI Collaborative Project 2.1.

THE DRIVE TO CREATE IMPACT ACROSS THE WORLD

EAST AFRICAN COUNTRIES CHAMPION INTEGRATED RICE SECTOR DEVELOPMENT IN THE REGION TO CURB ESCALATING IMPORTS

The East Africa Rice Conference (EARC) 2021 gathered key players from Africa’s agri-food sector. They listed the top regional priorities to be: increased availability and access to quality inputs via harmonized regional policies and regulations, public-private partnerships support in value-chain upgrading and regional trade in local rice, and strengthened regional and national platforms to promote policy coordination and investment. These priorities will champion integrated rice-sector development in the region.

EARC 2021 was organized by the Africa Rice Center, the Agricultural Policy Research in Africa Programme of the Future Agricultures Consortium, the Centre for African Bio-Entrepreneurship, the Coalition for African Rice Development, IRRI, and the Japan International Cooperation Agency, with support from UK Aid and the Foreign, Commonwealth & Development Office of the United Kingdom. The event featured prominent scientists, experts, and thought leaders, who discussed local and regional challenges and presented a range of opportunities for research and development in rice-based agri-food systems.

GENDER TRANSFORMATIVE CHANGE CRITICAL FOR AN EQUITABLE RICE SECTOR IN AFRICA



The extent of women’s participation and the roles they play in agri-food systems may vary across countries and regions, but the reality remains the same: women are central to the sustainable development of agri-food systems. However, social, political, and market institutions, which govern food systems, portray elements of gender bias at all levels, holding back women in vicious cycles of time and income poverty.

Ranjitha Puskur, research leader for Gender and Livelihoods at IRRI, presented *Gender Equality and Sustainable Rice Agri-food Systems Transformation in Africa: Nurturing Synergies* at the EARC 2021. While women have the potential to become powerful agents of change, driving food systems transformation in Africa, Dr. Puskur suggests a shift in perspective to ask, “How can agri-food systems support gender equality?”

VIETNAM EXPANDS CS-MAP PROGRAM AFTER SUCCESSFUL IMPLEMENTATION IN MEKONG DELTA

The Winter-Spring rice crop of 2019–2020 was a successful harvest in the Mekong River Delta (MDR) despite the most severe salinity intrusion in history. The salt-water intrusion period in 2020 started almost 3 months earlier and lasted longer compared with the previous years’ average. The salinity levels constantly remained at high levels from February to May, threatening rice production. Nevertheless, MRD provinces managed to win big—the result of a set of adaptive measures, particularly the shift in cropping structure and sowing and harvesting calendars, guided by the implementation of the Climate-Smart Mapping and Adaptation Planning (CS-MAP) approach.

The CS-MAP methodology was developed by scientists at IRRI within the CGIAR Research Program on Climate Change Agriculture and Food Security in Southeast Asia and in cooperation with Vietnam’s Ministry of Agriculture and Rural Development. This approach was a response to the increasing adverse impacts of climate phenomena that negatively affect agricultural production in Vietnam.

AFTER COVID-19: WHERE TO NEXT FOR CLIMATE-RESILIENT AGRICULTURAL DEVELOPMENT IN THE GLOBAL SOUTH?

The conjunction of the agricultural innovation system and the food system needs to be understood to see the options available to smallholder farmers. There is no “one-size-fits-all” technological solution. Instead, there are radically different and competing perspectives on the right path to take—and for which scientific evidence by research organizations, such as CGIAR, can help national governments to assess the most sustainable pathway for their communities.

The COVID-19 pandemic may present an opportunity to build back better if we move away from the standard model of structural transformation that has permeated development practice over recent decades. Instead, if we focus on reinvigorating rural communities through a climate-resilient smallholder agriculture sector and move away from the urban bias, then there is the hope that the rural sector will be the engine of recovery in the global south.



THE DRIVE TO EXCEL

IRRI WINS GLOBAL FOOD SYSTEMS CHALLENGE FOR ARSENIC-SAFE RICE

In October 2021, IRRI was announced as one of the four finalists, out of nearly 900 preliminary submissions, in the inaugural Seeding The Future Global Food System Challenge, an initiative by the Seeding The Future Foundation in collaboration with the Institute of Food Technologists.

In January 2022, IRRI received the Grand Prize for its groundbreaking development and deployment of rice cultivars resilient to arsenic toxicity, providing a safer food crop option in arsenic-polluted regions.

The occurrence of carcinogenic arsenic minerals in waterlogged paddy topsoil poses danger to rice production and consumption worldwide. Bangladesh is in desperate need of arsenic-safe rice varieties to solve the problem of arsenic contamination in rice in areas where up to 40 million people are exposed to this class I carcinogen.

“Chronic arsenic exposure has been associated with a variety of potentially harmful health consequences in humans, including skin lesions, hypertension, cardiovascular illness, pulmonary disease,

reproductive and neurological dysfunctions, hematological abnormalities, and skin cancer,” said Dr. Jauhar Ali, Research Unit Leader at IRRI. “Arsenic-safe rice will be made freely accessible to farmers, and breeders will be encouraged to incorporate these varieties into breeding programs, allowing arsenic-safe rice to become the new standard. Implementation on a large scale would have a substantial positive socioeconomic impact on the health of consumers and marginal rice-farming communities, particularly women and children.”

IRRI LEAD SCIENTIST ON GOLDEN RICE RECOGNIZED BY PHILIPPINE PLANT SCIENCE COMMUNITY

The Crop Science Society of the Philippines (CSSP) recently presented the Achievement Award in Research to B.P. Mallikarjuna Swamy, a senior scientist at IRRI, for his significant contributions to the improvement of the nutritional value of rice, and in particular for his outstanding research on Golden Rice that contributed to its food regulatory approval in the country.

The award was in recognition of Dr. Swamy’s expertise and commitment

to his work that led to the development of important research for Golden Rice, specifically rice biofortification using transgenic methods and introgressing genes for beta-carotene production in the endosperm of rice. CSSP cited Dr. Swamy’s major role in the issuance of the Golden Rice Propagation Permit in the Philippines, which will make Filipino farmers the first in the world to plant Golden Rice for commercial use. His rigorous studies on Golden Rice’s food compositional analysis and safety provided the Philippines regulatory system for genetically modified organisms with the evidence needed to approve the planting of this biofortified rice in the country.

LILIA R. MOLINA RECEIVES DISTINGUISHED ACHIEVEMENT AWARD IN LABORATORY AND RESEARCH MANAGEMENT

The Kapisanang Kimika ng Pilipinas-Southern Tagalog

awarded Lilia R. Molina, Research Manager and Cluster Leader of the IRRI Service Laboratories the 2021 KKP-ST, Inc. Distinguished Achievement Award in Laboratory and Research Management.

The citation was given in recognition of her outstanding contributions as an analytical service laboratory head and research manager. Her exceptional managerial skills and technical know-how contributed significantly to raising and sustaining the excellent quality standards of IRRI’s research and service laboratories.

Ms. Molina manages the team responsible for all grain quality evaluation and analytical testing activities as well as the operational activities of the IRRI Service Laboratories, including the Grain Quality and Nutrition Services Laboratory (GQNSL) and the Genotyping Services Laboratory. She took the lead in the ISO 17025 accreditation of the GQNSL for compliance with laboratory competence.



Dr. B.P. Mallikarjuna Swamy



Ms. Lilia R. Molina

STATEMENT BY THE CHAIR OF THE IRRI BOARD OF TRUSTEES FOR THE YEAR ENDED 31 DECEMBER 2021

With the ongoing CGIAR system-wide transition, and with the pandemic extending into its second year, 2021 has been a period of adjustment for IRRI. Nevertheless, the institute as a whole and its people in particular, has proved remarkably resilient and adaptive, finding innovative ways to deliver on our mission. While there were challenges, many also found opportunities. We continued to engage in global discussions revolving around climate change and food security, increasing our profile and influence in these important dialogues. We strengthened our relationships with our partners, exploring unique avenues for collaboration and fundraising. And we integrated digital technology into our systems and processes, helping advance operations and research while keeping people safe.

IRRI's staff continues to be our greatest asset, delivering world-class science enabled by exceptional corporate services. Our Human Resources & Organizational Development Team has worked to expand the services and support offered to staff this year providing additional resources to support their health and wellbeing needs as we continue through a protracted COVID-19 pandemic. IRRI's staff has adapted to remote working requirements well and as such IRRI has issued new policies which provide more flexible working arrangements for staff in the future. IRRI's staff turnover rate for 2021 was 12%, which is slightly higher than global averages for similar organizations. IRRI currently has 917 staff, approximately 10% of which are internationally recruited.

FINANCIAL HIGHLIGHTS

Despite the operational slowdown caused by the COVID-19 pandemic impacting the Institute's ability to deliver research activities according to original timelines, IRRI's financial position remains stable in 2021. Total Assets decreased to USD 74.891 million, from 2020 Total Assets of USD 75.455 million. The slight decrease of USD 564 thousand is mainly driven by capital expenditures contributing to a decrease in cash levels. The liquidity and long-term stability indicators remained above CGIAR benchmarks.

Following surplus results in 2019 and 2020, IRRI reported a net surplus of USD 219 thousand in 2021. The surplus resulted from prudent cash management and effective cost control, which allowed IRRI to manage both short and long-term investments, and gain a healthy level of financial income. This counteracted the negative effects of the slowdown in research operations and the deficit from normal operations. In 2021, IRRI's grant portfolio was USD 52.462 million, which consists of USD 15.397 million of Windows 1 and 2 funds and USD 37.065 million of Bilateral and Window 3 funds.

For 2022, the budget will be USD 61.86 million, an increase from the 2021 budget of USD 55.08 million. IRRI has been allocated USD 19.3 million from pooled funds (formally, Windows 1 and 2), an increase of USD 3.9 million compared with the 2021 allocation. Under its new mandate as the host of the Regional Hub for Southeast Asia and the Pacific, IRRI will need additional resources to perform this new function.

RESEARCH ACHIEVEMENTS

IRRI, in collaboration with its CGIAR partners Africa Rice Center, the International Center for Tropical Agriculture (CIAT), and over 600 partners across the globe, successfully concluded the CGIAR Research Program on Rice (RICE CRP) in December 2021. RICE CRP ran from 2017 to 2021, and aimed to address 9 of the 17 United Nations Sustainable Development Goals (SDGs) and 26 of their 169 targets. As committed, the program's budget implementation rate is 100%.

An exciting milestone in 2021 was the beginning of Phase III of the CORIGAP Project. Funded by the Swiss Agency for Development and Cooperation (SDC), this long-term project started in 2012 and brought together IRRI with various country partners to optimize the productivity and sustainability of irrigated rice production systems. The outcomes of CORIGAP Pro (Phase

II 2017-2020) exceeded all indicators of project success, helping validate SDC's long-term investment with IRRI and strengthening relationships with partner countries. Launched in December 2021, CORIGAP Phase III (2021-2022) will document, develop, and disseminate all its learnings, research, and knowledge products through various channels (like the recently launched CORIGAP Digital Library) to support stakeholders around the world in implementing their agro-ecological transition toward sustainable rice systems.

Research accomplishments during this year include the completion and deployment of native trait resistance genes for key plant pests and diseases. These include resistance genes for rice yellow mottle virus and major blast and bacterial leaf blight. These represent the first time that these genes have been available in an elite background in modern breeding programs, helping significantly advance breeding efforts for ensuring robust resistance to destructive rice diseases. In addition, a gene identified two years back was validated and patented for increasing yield without trade-off with grain quality. This overcomes a classic physiological bottleneck and is the first success in a deliberate attempt at maintaining grain quality while increasing yield.

Also this year, an IRRI-led multi-sectoral consortium called the Network for Accelerated Rice Varieties for Impact was established, enabling private sector partners to test new IRRI elite inbred rice for breeding

in various countries. This initiative will speed up the transfer of technologies and advance collaboration and networking in key research and development areas.

Several new research discoveries have also been made, heralding exciting new research pathways. In one case another gene was identified for DNA metabolism and proven useful in modifying root architecture for drought tolerance and with the potential to affect nitrogen remobilization. In addition, there is also the discovery of antioxidant and anti-cancer properties in some traditional rice varieties, and a breakthrough in increasing the yield of a rice variety with an extremely low glycemic index.

During this year IRRI also took the opportunity to build our capacities and optimize operational efficiency. These include establishing the Speed Breeding facility at ISARC and the Grain Quality Laboratory at IRRI Bangladesh, modernizing the International Rice Genebank (IRG) and Seed Health Unit, and developing new quality and management systems for more structured processes across platforms.

SELECTED CONTRIBUTIONS TO THE SDGS RELATED TO FOOD SECURITY AND POVERTY REDUCTION

- A meta-analysis compared Site Specific Nutrient Management (SSNM) with farmers' fertilizer practice for maize, rice and wheat using 61 published papers across 11 countries. Relative to the farmer practice, across the crops maize, rice and wheat, SSNM increased grain yield by 12% (contributing to food security) and profitability by 15% with 10% less fertilizer nitrogen applied (contributing to zero poverty and enhanced sustainability). From the cultivation of the flood-tolerant rice variety SS1, households in Assam, Odisha and West Bengal in India gained an additional yield of 527-1,023 kg/ha, amounting to an additional income USD 67-134/ha.
- The adoption of submergence-tolerant rice varieties in northern Bangladesh increased yield, profit, and home rice consumption by 6%, 55%, and 15% respectively.
- The improved rice management package "1 Must Do-5 Reductions" reached 104,448 smallholder rice farmers and adopted on 114 thousand hectares in the Mekong River Delta of Vietnam, resulting in 19-36% higher income. In total, over 780,000 farm households in Southeast and East Asia adopted improved rice management practices.



- Findings from economic surplus analysis indicate that the net present value of IRRI's contributions to rice varietal yield changes in Bangladesh over the 1990-2018 period ranged from USD 3.3 to 6.5 billion. The net present value of IRRI investments in Bangladesh in the water-saving practice of Alternate Wetting and Drying ranged from USD 14 to 146 million, and in SSNM technology from USD 140 million to USD 148 million.
- The impact assessment of IRG on improved rice varieties in eastern India revealed that 45-77% of the genetic composition of improved rice varieties comes from the genes of IRG accessions. A 10% increase in the genetic contribution of IRG accession on an improved rice variety increases the yield by 27%.

PARTNERSHIPS FOR IMPACT

IRRI has been active in various international summits and discussions, contributing our expertise and evidence-based data to the conversation. These include the Nutrition 4 Growth Summit in Tokyo, the COP26 in Glasgow, and the CGIAR-India consultations. We have also been actively engaging with many of our

international and national partners, continuing existing projects and exploring new potential collaborations.

In Nepal, we established a new 5-year collaborative project to help the country increase its domestic rice production, with a focus on hybrid rice development. In the Philippines, we have concluded a successful year-long project on laser land leveling and formally transitioned the Rice Crop Manager Advisory Service to the Department of Agriculture. In India, we partnered with the government of Assam to increase production of premium black rice varieties, and a newly-launched project will help promote diversification of rice-based systems in Odisha, enhancing climate and livelihood resilience especially for women farmers. The institute also established collaborations with private sector companies Loc Troi Group in Vietnam, APV Austria, and DLG Germany for partnerships in areas of mechanization, postharvest, rice straw management, and low carbon rice.

IRRI's capacity-building efforts were able to adapt and pivot online, helping us continue to better reach individual, institutional, and system-level stakeholders. IRRI Education refreshed its training approaches to integrate across virtual and digital channels, allowing for a dedicated learning management system that

was able to host 39 courses and reach over 1,300 participants (40% of them women) around the world. In addition, self-paced learning modules were also launched for participants to learn in their own time and schedule.

In 2021, CGIAR laid the groundwork for establishing a strengthened and collaborative relationship between the new unified One CGIAR Organization and the Association of Southeast Asian Nations (ASEAN). These series of meetings and engagements discussed the One CGIAR transition, introduced its new research and innovation strategy and initiatives portfolio, and showed how the integrated capabilities of the unified organization can work together with the regional body and its member-states to create co-developed and demand-driven programs that can more effectively and holistically combat challenges like food and nutrition insecurity, climate change, and resources degradation. As CGIAR Regional Director for Southeast Asia and the Pacific, IRRI Director-General Jean Balié was a lead representative in these engagements, leveraging IRRI's robust relationships with ASEAN nations to help raise strong support. The development of an ASEAN-CGIAR "Innovate for Food" Regional Program, which is being co-developed with the ASEAN Secretariat and Member States through a consultative process, is on track for full ASEAN endorsement in 2022.

PROGRESS IN THE IMPLEMENTATION OF ONE CGIAR

IRRI is the host of the CGIAR Regional Hub for Southeast Asia and the Pacific, and has been very active in 2021 developing the CGIAR's portfolio in the region. This has included multiple consultations introducing the CGIAR and its capacities with key stakeholders in each of the regions and countries, initiating strategy development processes for expanding the CGIAR's engagement within ASEAN, in China, and in the Pacific, and working with the ASEAN Secretariat and ASEAN Member States to develop a multi-year research and innovation development program to support the strategic themes of recovery, resilience, and transformation. Capitalizing on IRRI's presence and reputation in the region, and with sufficient resourcing and tailored interventions, there is enormous potential for impact to be delivered by the CGIAR through the Regional Hub for Southeast Asia and the Pacific.

Another significant step in the transition toward One CGIAR in 2021 was the endorsement by the System Council of a new operational structure encompassing research delivery and impact, global engagement and innovation, and institutional strategy and systems. Managerial appointments for the functioning of this operational structure were made with Global, Regional, and Science Group Directors appointed throughout the year. IRRI has also agreed to the One CGIAR Implementing Arrangement No. 1, which governs the affiliation and management of personnel to the One CGIAR Integrated Operating Structure. Building on IRRI's mandate, and through the transition process the CGIAR has agreed to demonstrate a renewed emphasis on Research for Development in Rice-based Agri-food Systems.

The year 2021 may have presented us with many challenges, but IRRI has come out stronger and ready for the important work ahead. 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.

Suthad Setboonsarng
Dr. Suthad Setboonsarng
 Chair
 Board of Trustees

2021 FUNDING SOURCES

