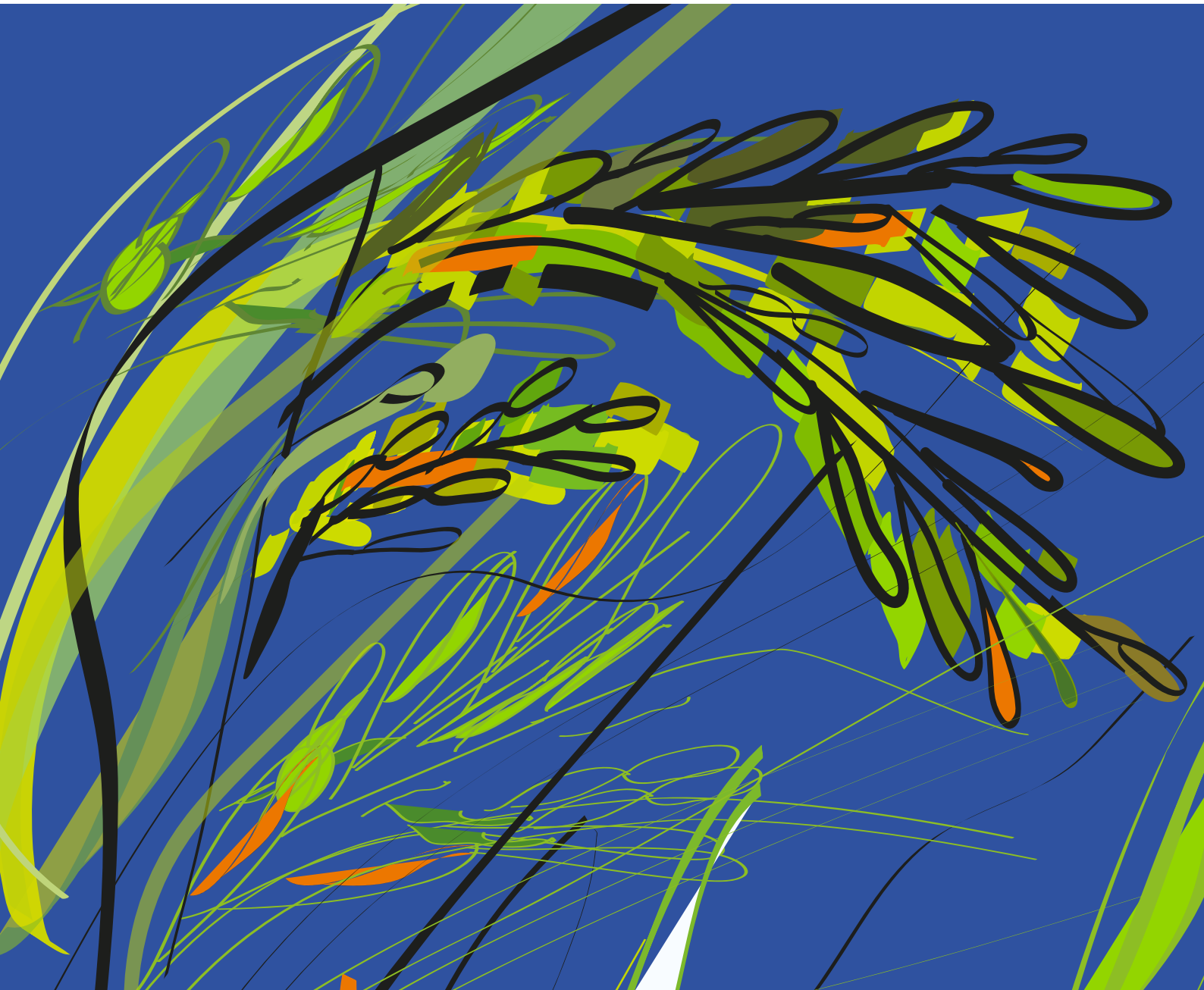


## Rice roadmap summary

# The road to sustainable rice growing [2023-2033]



# The road to sustainable rice growing [2023-2033]

In some Southeast Asian languages, such as Khmer (in Cambodia) or Lao (in Laos), “eating” is synonymous with “eating rice”, which proves the importance of the cereal in the local diet. And while rice is primarily grown and eaten in Asia, it is also widely consumed on other continents, such as Africa, which imports large volumes. However, the sector faces a range of growing challenges. To support sustainable rice growing and inform the choices stakeholders need to make, CIRAD pinpointed four ambitions that will frame its rice research over the coming decade. ■



**R**ice is a staple food for people the world over, and contributes to food security in many countries, particularly in the global South. The fact that rice has been grown continuously in many areas for more than a thousand years is proof of the resilience of aquatic rice-growing systems, which provide more than three quarters of the world’s rice. In many world regions, including Europe, rice growing plays a major role in the sustainable development of and biodiversity conservation in delta zones. Rice is also grown in more fragile mangrove ecosystems and non-flooded areas, particularly in Africa and Latin America.

The rice value chain is marked by substantial agro-socioeconomic diversity:

- different cropping methods may be used: irrigated, rainfed lowland and rainfed upland systems,
- rice may be grown as a food or export crop,

## Producing more to feed an ever-growing population

- rice growing may be intensive or extensive in terms of labour and/or chemical inputs (fertilizers, herbicides and pesticides),
- producers range from family farmers to industrial firms.

In 2021, the global rice harvest totalled 525 million tonnes, almost 90% of which was produced and consumed in Asia. The continent also produces the largest surpluses and exports to the rest of the world, particularly to sub-Saharan Africa, the world’s main deficit area in terms of rice and leading importer, with a third of global imports.

CIRAD works across the entire range of contexts, from West Africa and the Indian Ocean to Asia and South America.

### A range of challenges

The challenges facing the sector are similar regardless of continent or farming

system. The task ahead is both clear and daunting: guaranteeing food security for a growing global population will mean producing more, on less land, with less water and probably less labour, while respecting the environment more and emitting less greenhouse gas (GHG).

The case of sub-Saharan Africa warrants particular attention, with a population set to double by 2050, from 1.1 billion in 2020 to 2.1 billion. For rice, the zone is highly dependent on imports, and thus very vulnerable to global market instability. The 2008 world price surge triggered a major crisis. African governments and their partners overseas responded by supporting local value chains, with one main objective: to achieve rice self-sufficiency. However, the support programmes implemented have failed to make the region less dependent ■

# Inventing the rice sector of the future: four ambitions to frame operations

**W**ith some sixty years of rice research under its belt, CIRAD has a wealth of knowledge and resources relating to rice production, processing and marketing. They include genetic resources and a resource collection (Tropical Plant Biological Resource Centre), and databases covering genetic and genomic resources and associated phenotypes (Orygenes-DB, OryzaTagline, Rice Genome Hub). CIRAD also heads a global rice market watch tool (Osiriz).

The organization has ten research units doing research on rice, under the umbrella of its three departments, focusing on biological systems (BIOS department), tropical production and processing systems (PERSYST department), and environments and societies (ES department). Those departments' resources will serve to work towards the four ambitions set.

## Ambition 1

**Make rice systems more sustainable, thanks to the agroecological transition**

The successful agroecological transition of rice systems, be they low-input (like in Africa) or synthetic input-intensive (like in Asia and Latin America), hinges on three levers that CIRAD intends to activate. Firstly, this will mean making use of and fostering rice genetic diversity and biological processes within rice systems. The aim is to improve rice production and

access to rice while making systems more resilient, broadening the range of ecosystem services and boosting household incomes. The second lever is building technical and organizational capacity among stakeholders, to allow them to build and support agroecological innovations. Thirdly, CIRAD is working to understand how public policy can help to make the technological transition on rice farms socially acceptable.

## Ambition 2

**Contribute to sustainable management of rice systems by managing water**

Both irrigated and flooded rice systems are highly dependent on water, which is in increasingly short supply. To ensure more efficient water use, CIRAD works to generate knowledge and design integrated irrigated or flooded systems combining territorial planning methods with appropriate cropping systems and varieties. Through this second ambition, our research helps to diversify production systems, cut GHG emissions within irrigated systems, and fight salinization and heavy metal pollution. It also serves to breed rice varieties and foster associated microbial communities that make rice more tolerant of water stress. Lastly, in line with this ambition, CIRAD intends to help stakeholders build institutions and practices to guarantee the long-term

functionality of installations and fair sharing of water resources.

## Ambition 3

**Improve and promote rice quality**

The third ambition concerns technical and organizational changes to generate value and distribute it fairly among stakeholders. The aim is to pinpoint levers for improving rice quality and boosting added value, to benefit family farmers in particular. This ambition will also involve exploring new market opportunities and associated certification processes, defining what makes local value chains competitive with respect to the global market and imported rice circuits, and questioning current public policy regarding the value chain.

## Ambition 4

**Help to adapt rice growing to global changes**

The many likely future climate, ecological, social, economic, health and other changes will have an impact on rice growing. CIRAD is therefore working on foresight studies and analyses on a global scale, to inform decision making. On a territory level, its research will be focusing on using multi-stakeholder participatory approaches to make rice systems more resilient. ■

To access CIRAD publications on rice: <https://agritrop.cirad.fr>



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A. Ripoché, CIRAD



C. Rebolledo, CIRAD

## Details

**Achieving agroecological transition, managing water resources sustainably, improving and promoting quality, adapting to global change, etc... a look at the key details of the roadmap, with plant pathology researcher Didier Tharreau and economist Patricio Mendez del Villar, CIRAD rice research coordinators.**



**How might the agroecological transition make production systems more sustainable?**

**Didier Tharreau (DT):** In so-called “intensive” systems, the agroecological transition means substantially reducing synthetic input (fertilizer and pesticide) use. This is a major issue, with repercussions for human and environmental health. Some rice farming systems (deltas, protected areas, rain-fed rice) are particularly fragile and deserve particular attention. Agroecological solutions are one way of protecting them.

**Patricio Mendez del Villar (PMV):** Reducing input use makes rice growers less reliant

on products that are often imported, not always available, and dependent on the global geopolitical situation. It also helps to cut production costs, given that input prices are constantly rising. In Africa, for instance, fertilizer prices have quadrupled in the past two years, due to the pandemic, an increase that has been exacerbated by the war in Ukraine and its repercussions for world trade.

**Why is managing water resources a key ambition in the CIRAD rice roadmap?**

**PMV:** Apart from rainfed rice (barely 20% of farms worldwide), most rice systems are flooded. In view of the growing impact of climate change, water management is a priority.

**DT:** Water is increasingly scarce, because of climate change and an increase in the number of different uses, which has exacerbated competition between users. We must therefore continue to produce, but with less water. Improved water management could also foster more efficient systems emitting less GHG (rice growing is responsible for a large share of GHG emissions from human activities, for instance 7% of global methane emissions; source: IPCC, 2010).

**How can we improve and promote rice quality, and why should we?**

**PMV:** Quality is an issue throughout the rice value chain. It is not just a question of technology (research on the plant, organoleptic properties, etc), but of using quality to promote rice better in marketing terms, which also requires organizational changes. Over the past 30 years, we have noted that consumers increasingly recognize and look

for quality, including that of imported and local rice in Africa.

**DT:** Our roadmap looks at quality on a global level. CIRAD is keen to work with rice growers to develop labels recognizing specific types of rice systems and help African trade associations to distinguish themselves from imported rice, for instance by promoting local rice from different regions. Improving rice nutritional quality is another aim.

**Why speak in terms of adapting to “global change”?**

**DT:** We deliberately chose to talk about “global change” because in addition to covering the effects of climate change on rice growing in our research, we also wanted to look at other phenomena such as trade globalization, which has triggered increased rice disease circulation, among other things.

**PMV:** The various recent crises, such as the Covid-19 pandemic or the war in Ukraine, have highlighted the need to build more resilient rice systems. One other major change is the explosion in demand: assuming there are 2 billion more people worldwide by 2050, another 150 Mt of white rice (or its equivalent) will be required (for a figure of 525 Mt in 2021). Working on change means building multidisciplinary, multi-institutional foresight approaches. For instance, CIRAD is a member of the Sustainable Rice Platform, a consortium set up to help players in the rice sector boost producer incomes and adapt production systems. ■

**Find out more:** [riceresearch@cirad.fr](mailto:riceresearch@cirad.fr)

### WAT4CAM: a project to improve water resource management and promote the agroecological transition in Cambodia's rice sector

Cambodia, which is one of the countries most vulnerable to climate change, has 3 million hectares of rice plantings, of which 0.5 million are irrigated in the dry season. Moreover, most irrigated plots are given extra water to overcome water deficits in the dry season. Setting up such irrigated systems generally results in the intensification of rice cultivation based on a combination of improved varieties, mineral fertilizers, and pesticides. The environmental footprint of irrigated rice is therefore a significant issue. With this in mind, the WAT4CAM

project set out to promote an agroecological transition in irrigated rice and vegetable systems that fosters crop diversification and linkages with fish and livestock farming. In addition to reducing the environmental footprint of rice growing, WAT4CAM is helping to improve the living conditions of rural communities, diversify their production operations, and strengthen relations between stakeholders by means of the national consortium for Conservation Agriculture and Sustainable Intensification (CASIC).



C. Robellodo

**Find out more:**



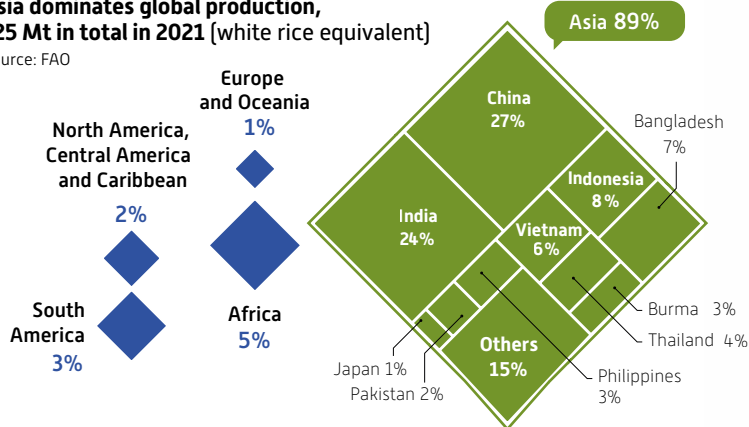


# In response to the many challenges, inventing the rice sector of the future

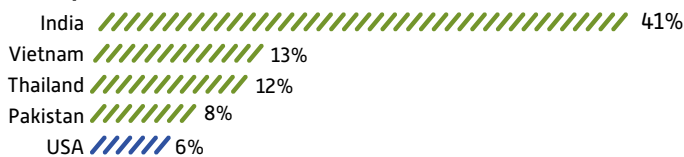
## Cultivation concentrated in Asia

Asia dominates global production, 525 Mt in total in 2021 (white rice equivalent)

Source: FAO

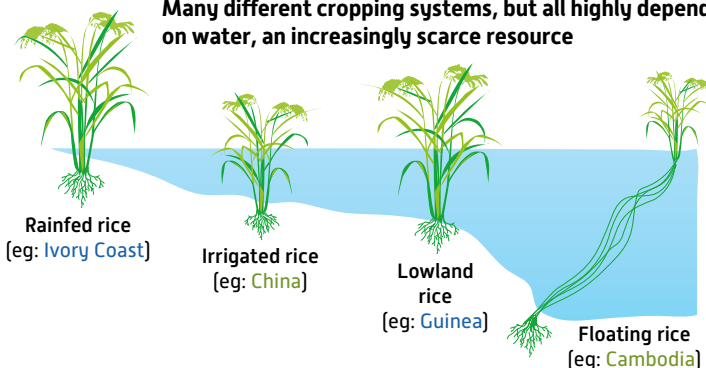


## And exports, 52 Mt in 2021



## In response to climate challenges and demand

Many different cropping systems, but all highly dependent on water, an increasingly scarce resource



## Rice, the staple food for more than half the population in sub-Saharan Africa

Production in sub-Saharan Africa is rising... and so are imports

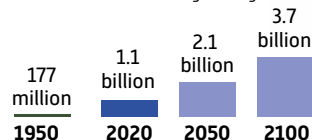


Each year, sub-Saharan Africa consumes 38.3 million tonnes of rice...

45% of which is imported



A challenge, since the population in Sub-Saharan Africa is growing



## Our ambitions...



Make rice systems more sustainable



Contribute to sustainable water management

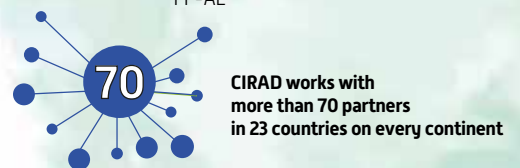


Improve and promote rice quality



Help to adapt rice growing to global changes

## ...in partnership



## Our means and resources

60

scientists from 12 research units

13

disciplines involved, from molecular genetics to sociology

210

publications with impact factor between 2006 and 2020

2000

subscribers to the OSIRIZ global market watch tool (in 4 languages): infoarroz.org



Open genome collections and resources

3000

rice accessions sequenced in partnership

## Partnerships, the core of CIRAD's research

**C**IRAD's rice research is founded on a wide range of partnerships in France and worldwide, with national agricultural research centres, technical institutes, universities, research organizations, ministries, producer groups, NGOs, and seed firms. CIRAD also works closely with the three CGIAR global centres involved in rice (CIAT, IRRI and AfricaRice), on projects such as the Global Rice

Science Partnership – GRISP (2011-2015) and subsequently the CGIAR Research Platform - CRP RICE (2016-2021), of which CIRAD was a founding member.

In France, CIRAD works with research organizations (INRAE, IRD, CNRS and Institut Agro Montpellier), universities and the Centre technique français du riz. ■

## A word from our partners



RR

**Interview with  
Jacqueline Rakotoarisoa,**  
agronomist specializing  
in rice and Scientific Director  
of Madagascar's National  
Centre for Applied Research  
and Rural Development  
(FOFIFA)

**What is the history of the partnership on rice between FOFIFA and CIRAD, and what are its main strong points?**

It is important to point out that FOFIFA took over from the French research institutes in Madagascar when it was founded in 1974. CIRAD is therefore a major historical partner for us. Our two organizations have always worked together, but as far as rice is concerned, our partnership was strengthened with the advent of an upland rice project in the 1980s, which primarily set out to breed and develop rice varieties suited to the cold climate of the Madagascar Highlands.

The cold-tolerant rainfed rice varieties bred and developed since the 1990s thanks to this partnership are world firsts. They have enabled the development of rainfed upland rice growing in the Madagascar Highlands. Moreover, they have been rolled out to other countries such as Nepal or Burundi, to enable them to develop rainfed rice growing under the same conditions. Over the years, our partnership has become more credible and more visible, notably thanks to the creation of joint skills platforms (PCPs) in 2002, a joint research unit (URP) in 2005 and platforms in partnership (dPs) in

2012, marked by the broadening of our partnership to include other organizations such as the University. Our partnership now has two main purposes: research and training. As a result, in addition to launching several research projects thanks to funding from various donors, we have also received, supervised and trained huge numbers of undergraduate students and allowed them to improve their scientific output by publishing a range of scientific articles.

**What have been the main difficulties and what lessons have been learnt?**

Despite these clear successes, nothing is ever perfect, and our partnership has come up against several major constraints. For instance, there is a shortage of financial and human resources in relation to the challenges faced. There is also room for improvement in terms of scientific leadership, which is complicated by the geographical dispersion of the partnership's members. And certain partners have not fulfilled their commitments. This has hampered the topics or programmes led by those partners. Working in partnership is generally mutually beneficial, provided all partners play the game. ■



RR

**Interview with Seng Vang**, Director of the Department of Agricultural Land Resources Management, General Directorate of Agriculture, Ministry of Agriculture, Forestry and Fisheries, Cambodia

**How was the partnership on rice initiated between CIRAD and your organization?**

The partnership was initiated to address land degradation problems and climate change in agricultural production in Cambodia. The partnership is aimed at intro-

ducing an alternative farming practice, called agroecology, which values biological diversity and natural processes (nitrogen, carbon, and water cycles), improving food crop yields for balanced nutrition, strengthening fair markets for the produce, and enhancing healthy ecosystems. It also aims to achieve sustainable food production systems and improve food nutrition and food safety.

**What are the main strengths of this partnership? What were the main difficulties encountered?**

This partnership has received global and regional support, and strong national support to promote the agroecological

transition. We face some difficulties, such as a lack of human resources with agroecological knowledge, insufficient physical resources (infrastructure and facilities), and limited financial support.

**What are the main lessons to be learned from this partnership?**

The partnership has been built on collaborative research between Cambodia and France, which generates scientific knowledge to support evidence-based decision making for agroecological transition in Cambodia and the region. It has also strengthened the international and regional network on agroecology. ■

Rice landscape in Madagascar (P. Marnotte © CIRAD)



CIRAD is the French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions.

CIRAD works with its partners to build knowledge and solutions and invent resilient farming systems for a more sustainable, inclusive world. It mobilizes science, innovation and training in order to achieve the sustainable development goals. Its expertise supports the entire range of stakeholders, from producers to public policymakers, to foster biodiversity protection, agroecological transitions, food system sustainability, plant, animal and ecosystem health, and sustainable development of rural territories and their resilience to climate change.

CIRAD is a public establishment (EPIC) under the joint authority of the Ministry of Higher Education and Research and the Ministry for Europe and Foreign Affairs.

CIRAD hopes that multi-stakeholder partnerships and alliances will discuss, share and support its four ambitions for sustainable rice growing. Contact us to find out more:

[riceresearch@cirad.fr](mailto:riceresearch@cirad.fr)

Working together for tomorrow's agriculture

[cirad.fr](http://cirad.fr)



CIRAD is a founding member of:

