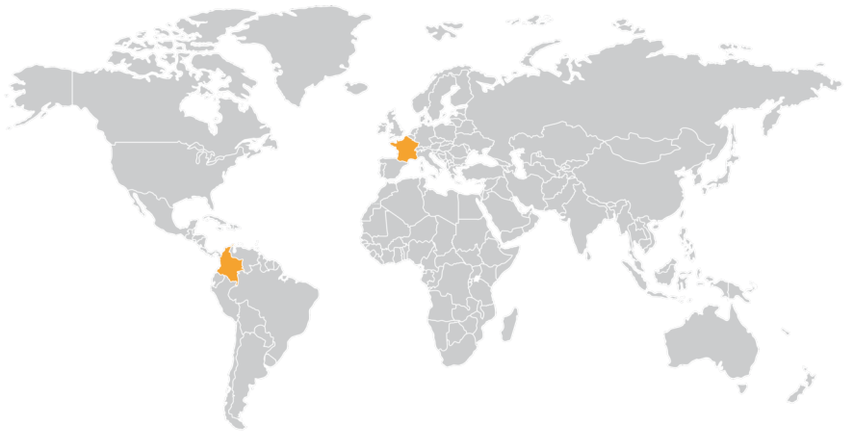
Rice Physiology Lab

Goal

Develop and implement advanced rice phenotyping tools to support climate change adaptation and mitigation—addressing high night temperatures, low solar radiation, water scarcity, carbon sequestration, and methane emission reduction. Through phenotyping of genebank accessions, we identify climate-resilient traits and supply elite parental lines to breeding platforms for varietal improvement.

Where we work

Rice Physiology Laboratory: Morphological, metabolic, physiological, and anatomical measurements of rice plants, development of phenotyping platforms for the breeding team, and creation of solutions to enhance the resilience and mitigation capacity of rice cultivars. We are located in France (CIRAD) and Colombia (Palmira Campus of the Alliance Bioversity & CIAT).



The boundaries and names shown on this map do not imply official endorsement or acceptance by the Alliance of Bioversity International and CIAT.

How we do it

- **Development of low-cost and forward-looking tools:** We design mobile platforms to evaluate a large number of rice plants in the field under real stress conditions. These mobile systems simulate future climate scenarios and the interaction between different factors such as heat, drought, elevated CO_2, and low light.
- **Identification of key traits for plant adaptation:** We develop methods to study plant resilience, including morphology (roots, stems, and panicles), anatomy (roots and leaves), physiology (panicle temperature, photosynthesis), and metabolism (non-structural carbohydrates), and we determine their relationship with yield and grain quality.
- **Focused on climate change mitigation solutions:** We identify plant traits that contribute to carbon capture and the reduction of methane emissions—key elements for climate change mitigation.

The impact

- **Genetic improvement:** We identify traits related to tolerance to heat, drought, high CO_2, and low light to support rice adaptation to climate change.
- **Exploration of genetic diversity:** We have evaluated 700 genotypes from different subspecies and wild rice accessions from the germplasm bank.
- **Support for breeding:** We have delivered 14 parental lines carrying adaptation and mitigation traits for crossing within the breeding platform in Latin America.
- **Accessible phenotyping:** We develop low-cost protocols and mobile platforms in collaboration with research centers across the region.

Actions for innovation

Climate-resilient phenotyping and platforms
We co-develop mobile and low-cost phenotyping platforms with partners. We simulate future climate scenarios and facilitate field evaluations. We train collaborators in climate-focused and mitigation-oriented phenotyping, sharing research protocols.

Low-emission parental lines and open data
We identify root and biomass traits associated with reduced methane emissions and increased carbon capture. We validate low-emission phenotypes and share genetic material and information on key genomic regions with the breeding program.

Trait discovery and integration
We combine physiological and genomic data to identify climate-adaptive traits. We accelerate their incorporation into breeding programs to develop climate-smart and resilient rice varieties aligned with future climate models.

Our partnerships

FEDEARROZ Federación Nacional de Arroceros · FLAR 30 Years Innovating rice, feeding the future · IHS Pontificia Universidad Javeriana Colombia · cirad · ómica · Bezos Earth Fund · Bill & Melinda Gates foundation · Colorado State University · IRRI International Rice Research Institute · Africa Rice Center Centre du riz pour l'Afrique AfricaRice

Technologies

Phenotyping platforms
Mobile field phenotyping units, simulation chambers for combined stress (e.g., high night temperature and CO_2), and canopy/panicle imaging systems equipped with RGB, thermal, and multispectral cameras.

Herramientas de medición:

- **Photosynthetic activity and plant transpiration:** Infrared thermometers, Li-600 MultispeQ chlorophyll fluorescence meters, portable photosynthesis systems (Li-6800, CI-600), and SPAD meters.
- **Biomass and carbohydrates:** LAI-2200C, drying ovens, balances, NIRS, HPLC, and grain analyzers used to evaluate biomass partitioning, non-structural carbohydrates, and quality traits such as amylose content and grain vitreousness.
- **Root and panicle architecture:** Epson 13000XL scanner and image analysis with WinRHIZO.
- Anatomy: Microscope, vibratome, Olympus camera, ImageJ software, and platforms such as BreedBase or custom workflows in R/Python for trait analysis.
- **Climate and soil sensors:** Environmental sensors for temperature, relative humidity, precipitation, radiation, light quality, soil moisture, and CO_2 concentration.

To know more about the program, visit us:

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