CIAT

Rice Program

Rice is a major crop for Latin America and the Caribbean (LAC).[1] The challenges of producing rice in an eco-efficient and sustainable way in a changing environment and for a growing population are enormous. To tackle them, we have adopted a multidisciplinary approach and actively collaborates with strategic partners, both regional and international.

Impact

The CIAT Rice Program, in collaboration with the NARES, has made significant progress in improving the crop's yields, pest tolerance, and nutritional quality. The Program has also contributed 60% of the 400 varieties so far released by LAC NARES.

Outputs and products

- Materials adapted to various rice-cropping systems (irrigated, low-input, favored, and savanna upland) and breeding nurseries for diverse ecosystems.
- Improved crop management has led to higher yields and lower costs, thereby increasing the competitiveness of thousands of farmers in several countries.
- Developed several genomic tools for gene discovery, and marker-assisted selection (MAS) strategies.
- Segregating populations and libraries of interspecific introgression lines.
- Screening techniques for rice pests.
- Protocols for grain quality and micronutrient testing, embryo rescue, double haploids, genetic transformation and pipeline, and water use efficiency.
- MAS methods for resistance to *hoja blanca* virus and rice blast.
- Methods for transgenic field trials under confined conditions.
- Synthetic population breeding and recurrent selection methods.
- Fingerprinting methods for variety identification and pathogen characterization.
- Capacity-building of students and LAC research staff.
- Development of networks for scientific information and germplasm exchange (GRUMEGA, Red-MeGA, and AgroSalud).
- Software packages: MapDisto, Paddy Genes Book, Paddy Map, CSSL Finder (mapdisto.free.fr).
- Databases for T-DNA rice lines and parentage of CIAT crosses.
- Statistical methods to analyze phenotypic and marker data.
- Consultancies, including statistical advice and training, to partners working on specific research projects.

Main activities

The CIAT Rice Program has several major areas of activities:

- **Integrated pest management**
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  For pathogens: Genetic and phenotypic characterization of *Magnaporthe oryzae* and *Burkholderia glumae* population.
  For rice: Identification of effective sources of resistance based on the composition of the pathogen population.
- **Genomic tools to improve breeding methods**
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  These tools include T-DNA and BAC libraries, phenotypic and molecular databases, strategies for bridge-building between rice species, marker technologies and high-throughput genotyping, universal core genetic map, and genetic analysis software.
- **Breeding new varieties using conventional and recurrent selection methods**
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1. For an explanation of acronyms and abbreviations see www.ciat.cgiar.org/newsroom/pdf/acronyms_syntheses.pdf

With LAC NARES, CIAT is improving rice lines for irrigated and upland conditions, using recurrent selection. Databases of varietal releases and parentage of CIAT crosses are available.

- **Use of wild and African cultivated rice species as sources of genetic variability**
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  The genetic base of LAC rice is being broadened by introgressing wild alleles into cultivated rice and constructing interspecific bridges with the genetically distant *Oryza glaberrima*.
- **Genotyping and phenotyping platforms**
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  Integrating these platforms to study the genetics and transgenesis of rice lines for increased resistance to drought, *hoja blanca* virus, and sheath blight; and for water and nitrogen-use efficiency.
- **FLAR–CIAT: a strategic alliance**
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  This public–private network covers 15 LAC countries. Together with CIAT, it develops the region's rice sector, introducing new technologies, including improved rice varieties, water-harvesting methods, and farmer-to-farmer technology transfer programs.

Main ongoing projects

- Rice lines with high iron and zinc contents.
- Exploring natural variation in rice.
- Developing interspecific bridges to give full access to the African rice allele pool.
- Promoting research on stable global food supplies.
- Management of the mite–bacterium–fungus complex in Central America and Colombia.
- Multi-country capacity-building on biosafety for LAC.
- Water and nitrogen use efficiency.
- MAS for resistance to hoja blanca and the rice planthopper (*Tagosodes orizicolus*).
- MAS for tolerance to cold temperatures.
- Introgression of traits of agronomic importance for developing improved germplasm for Colombian conditions.
- Hybrid technologies for heterosis in rice and related cereals.

Partners and collaborators

LAC

AgroSalud • Embrapa Arroz e Feijão • CENARGEN • FEDEARROZ (Colombia) • FLAR • GRUMEGA • IRGA • Lab. Ecofisiología Vegetal of IVIC (Venezuela) • NARIs of Argentina, Bolivia, Chile, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Nicaragua, Panama, Peru, Uruguay, and Venezuela

International entities

Agropolis • Arizona Genomics Institute • BBA (Germany) • Cirad • Colombian seed sector • Cornell and Yale Universities • Dale Bumpers National Research Center (USA) • Hannover University • INGER • IRD • JIRCAS • Kansas and Louisiana State Universities • Major universities of Colombia, Costa Rica, and Venezuela • Plant Genome and Development Lab. (France) • RiceTec, Inc. • Rutgers Biotechnology Center • Universities of Arizona, Arkansas, California (USA), Braunschweig (Germany), and Montpellier (France) • U.S. private sector

CGIAR centers

Africa Rice Center • IRRI

Donors

BMZ • CIDA • Cirad • EU • FAO • FONTAGRO • GCP • GEF • Génoplante (France) • HarvestPlus • Individual countries • IRD • MADR-FEDEARROZ (Colombia) • MAFF (Japan) • Ministry of Foreign Affairs (France) • NSF-Gates • OPEC • USAID • World Bank, Peru

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