



Photo credit: Hugh Rutherford for CIP

More than 300 million people, many below the poverty line, in developing countries depend on root, tuber and banana crops for food and income.

The CGIAR Research Program on **Roots, Tubers and Bananas (RTB) is working globally to harness the untapped potential of those crops in order to **improve food security, nutrition, income, climate change resilience and gender equity of smallholders.****

Root, tuber and banana crops – bananas (including plantains), cassava, potatoes, sweetpotatoes, yams, and tropical and Andean roots and tubers– are some of the most important staple crops in the world's poorest regions. They provide around 15% or more of the daily per capita calorie intake for the 763 million people living in the least developed countries. Often rich in key nutrients such as provitamin A, RTB crops can significantly improve nutrition and food security. Many RTB crops can be grown with few inputs and often under harsh conditions. Yet they respond very well to intensification and are high yielders in terms of calories produced per hectare. As important cash crops, they can help boost family incomes and are frequently grown or marketed by women.

But RTB crops present several common challenges. High genetic complexity means breeding is especially difficult and consumers often have particular quality preferences in addition to higher yield to be addressed. RTB crops are propagated clonally rather than with seeds, which means seed remultiplication is needed close to farmers' fields and allows yield-reducing pathogens to build up over time. This calls for a strong design of private-public seed systems. The crops' bulk and perishability creates opportunities for postharvest innovation. Whilst sometimes considered womens' crops their production and marketing involves women and men in varying ways putting a premium on understanding gender differences.

Impacts by 2022

By 2022, RTB together with its partners will achieve impact in the following areas:

- ▶ 20 million people, of which 50 percent are women, have increased their income
- ▶ 30,000 small and medium enterprises are operating profitably in the RTB seed and processing sectors
- ▶ 8 million farm households have increased crop yield through the adoption of improved varieties and sustainable management practices
- ▶ 10 million people of which 50 percent are women, have improved their diet quality
- ▶ 1.9 million hectares of current RTB crops production area converted to sustainable cropping systems.



Photo: Sara Quinn, CIP

Adoption of improved varieties

RTB improved varieties co-developed and released by CGIAR centers and National Agricultural Research Systems contributed to improving the productivity of smallholder farmers. Recent adoption studies, using farmers' surveys and DNA fingerprinting, revealed that:

1. In Nigeria, about 66% of farmers (3.1M households) had adopted improved cassava varieties, with a 64% gain in productivity associated with a 4.6% reduction in poverty.
2. In China and six Southeast Asian countries, over 80% of farmers had adopted improved potato varieties. In China, where almost 5M ha of potatoes are grown, 25% of the area is under CIP-related varieties.
3. In the seven most important African countries for world yam production, 28% of the area was cultivated with improved varieties and 13% of this area is under IITA related varieties.
4. In five African countries 7 % of the sweetpotato area was cultivated with improved varieties, almost 50% of which was related with CIP material.

Overcoming pests and disease

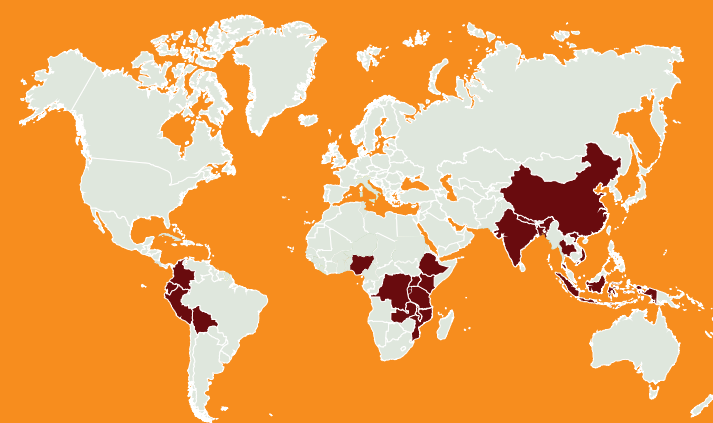
Invasive and emerging pests and diseases of RTB crops cause major yield losses for smallholders. With climate change, threats are expected to grow but knowledge is limited about which threats will be more severe and where. Using ICT tools, RTB teams are translating the results of complex analysis of climate, pest and disease biology, agronomy and varietal-related data into evidence and tools that can be made easily available to plant protection organizations, farmers and other stakeholders to support their decision-making process. Researchers from IITA and Penn State University have created a mobile app called 'Nuru' that identifies cassava diseases and pests. The app was designed in collaboration with Google, using TensorFlow, an open source software for object recognition. Nuru was crafted by taking 11,670 photos, to create 2,756 images of leaves which were cropped to form 15,000 images of leaflets. After experts diagnosed the diseases, the photos were organized into a database which was used to train the software using machine learning to recognize the symptoms of cassava pests and diseases. The app can be used by farmers or extension agents in the field. Plans are in place to expand the technology to cover other root, tuber and banana crops, including potato.



New mobile app diagnoses crop disease in the field.
Photo credit: IITA

Where We Work

RTB works in 26 primary target countries.



Africa: Ethiopia, Nigeria, Tanzania, Cameroon, DRC, Ghana, Kenya, Malawi, Mozambique, Rwanda, Uganda, Zambia, Burundi, Congo.

Latin America and the Caribbean: Bolivia, Colombia, Ecuador, Peru

Asia: Bangladesh, Vietnam, India, Nepal, China, Indonesia, Thailand.

Research

RTB's research comprises five flagship projects:

Flagship 1 - Enhanced genetic resources develops and applies leading-edge science toward faster and more precise development of user-demanded varieties, and enhance the long-term conservation and use of genetic diversity.

Flagship 2 - Adapted varieties and quality seed makes available good-quality planting materials of a diverse set of high-yielding varieties adapted to the needs and preferences of stakeholders in the value chain.

Flagship 3 - Resilient crops closes yield gaps of RTB crops arising from biotic and abiotic threats and develops more resilient production systems.

Flagship 4 - Nutritious food and added value supports the fuller, equitable, and sustainable utilization of RTB crops for healthier diets and improved income opportunities.

Flagship 5 - Improved livelihoods at scale improves livelihoods by scaling RTB solutions in agri-food systems, with special attention on gender equity and youth employment.

Addressing Critical Challenges in RTB Agri-food Systems

Increasing productivity

RTB crops, because of genetic complexity, present special problems for breeding. Clonal propagation requires innovative approaches to seed systems and lack of adapted crop management further contributes to yield gaps. RTB:

- ▶ Invests in new breeding technologies to accelerate gains and respond to producer, market, and consumer demands
- ▶ Develops adapted seed systems and variety dissemination models promoting commercial and semi-commercial schemes with public private partnerships
- ▶ Supports crowd sourced and information and communication technology approaches to improved agronomy

Supporting diversified nutritious diets

More than 800 million people worldwide remain undernourished, and the number suffering from micronutrient deficiency is even greater. Women of reproductive age and young children are most vulnerable to undernutrition because of their greater nutritional needs and social marginalization. In addition, population growth and changes in dietary preferences will increase food demand in countries where people are highly dependent on RTB crops. RTB:

- ▶ Maintains and enhances the genetic diversity of RTB crops tapping into unexplored potentials
- ▶ Supports crop improvement for biofortification addressing local constraints and consumer preferences
- ▶ Designs programs integrating agriculture, nutrition and health

Creating new entrepreneurial and job opportunities

Fast growing urban population and changing patterns of agri-food demand in rural and urban areas may create new opportunities for smallholders in rural and peri-urban areas. RTB:

- ▶ Opens new gender equitable opportunities for employment and income generation through the profitable sale of diverse, locally available, high-quality RTB seed
- ▶ Strengthens smallholder business organization and promotes entrepreneurial and business management competencies among women, men, and youth
- ▶ Develops energy-efficient and environmentally-friendly post-harvest technologies for small and medium-scale businesses

Addressing biodiversity loss, soil and landscape degradation and challenges of climate change

The expansion of the agricultural frontier and land use intensification are leading to natural resources degradation and reductions in critical ecosystem services. Climate change is expected to affect agricultural production, increasing constraints of water and temperature and changing pest and disease dynamics and spread. Genetic diversity will be threatened by changing environments, reduced ecosystem stability, and increased pressures on land use. RTB:

- ▶ Supports in-situ and ex-situ conservation of landraces and crop wild relatives as well as improved genetic material
- ▶ Develops RTB-based sustainable intensification strategies at farm and community level including improved agronomic practices for improved soil fertility and water management
- ▶ Invests in breeding programs for drought and heat tolerant varieties with improved resistance to pests and diseases
- ▶ Proposes integrated pest and disease management strategies including gender-responsive techniques and practices



Why Roots, Tubers and Bananas?



50 g/day of **orange fleshed sweetpotato** can meet the vitamin A requirements of a young child.



300 million poor people in developing countries depend on roots, tubers and bananas for food and nutrition security and income.



The number of people involved in RTB agri-food systems could more than **DOUBLE** by the end of the 21st century.



RTB crops are the **most important set of staple food crops** after cereals, based on average production.

**763
MILLION**

RTB crops provide **15%** of the daily per capita calories intake for the **763 million** people living in least developed countries.

Global Partners for Impact

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Working to Achieve the Global Goals

RTB and its 2022 targets are fully aligned with the following SDGs:



The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a partnership collaboration of research-for-development stakeholders and partners. The shared purpose is to tap the underutilized potential of root, tuber, and banana crops for improving nutrition and food security, increasing incomes and fostering greater gender equity – especially amongst the world's poorest and most vulnerable populations. CGIAR is a global research partnership for a food-secure future. Its science is carried out by 15 Research Centers in close collaboration with hundreds of partners across the globe.

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www.cgiar.org/funders

Contact us

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