CIP
INTERNATIONAL POTATO CENTER

CGIAR

Annual Report 2019

Discovery to impact

Science-based solutions for global challenges

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Cover photo: Sweetpotato vine distribution in Mozambique (Credit CIP/I. Corthier)

July 2020

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Nutrition education in Bangladesh (Credit CIP/S. Quinn)

Foreword

Genetic markers facilitate breeding resilient potatoes with characteristics local people want. (Credit CIP/H. Rutherford)

As the effects of climate change on food systems become more apparent and the COVID-19 pandemic lays bare inequalities across the world, the case for investment in targeted agricultural research-for-development has never been greater. Research to enhance understanding, conservation and fair use of the world's agrobiodiversity is crucial in building resilience in the face of global warming. Research to help increase food production by 60% over the next 30 years, while remaining within the planet's environmental boundaries, is critical. And research for more nutritious, sustainable food systems capable of generating inclusive growth for millions of men, women and young people is needed now more than ever.

In our post-COVID world, a return to business as usual is not a viable option. More sustainable land use and enhanced food safety would offer us greater protection against the likelihood of future pandemics. Now is the time to reinvent our food, land and water systems. This does not mean starting from scratch. The International Potato Center and its partner CGIAR centers have over 50 years of experience in generating concrete outcomes. Early CGIAR research sparked major gains in agricultural productivity in developing countries which saved more than a billion people from starvation. Since then, our collective discoveries, resilient varieties, innovations and policy guidance have boosted the incomes, nutritional outcomes, and well-being of tens of millions of families globally.

The third and sixth most important food crops in terms of human consumption, potato and sweetpotato have played an important role in global efforts to reduce hunger, malnutrition and poverty. Since 2010, CIP innovations and development interventions have reached over 8.5 million households, improving diet diversity, resilience, and employment and livelihoods. While our efforts are largely concentrated in Africa and Asia, we have renovated our focus in the Andes, a biodiversity hotspot of global importance that is especially vulnerable to climate change. We have begun testing climate-smart approaches with the potential to improve nutrition security and livelihoods, both for the region and beyond.

For CIP, a more resilient future means focusing on inclusion in all our work: from the crop varieties we breed to the market innovations we develop. Adopting a gender-responsive approach produces better outcomes. As we foster positive change through our research for development, CIP has prioritized diversity across the organization. More than 40% of our personnel are women, including science leadership, senior management and the board of trustees. Diversity at CIP is a stepping-stone to more inclusive delivery.

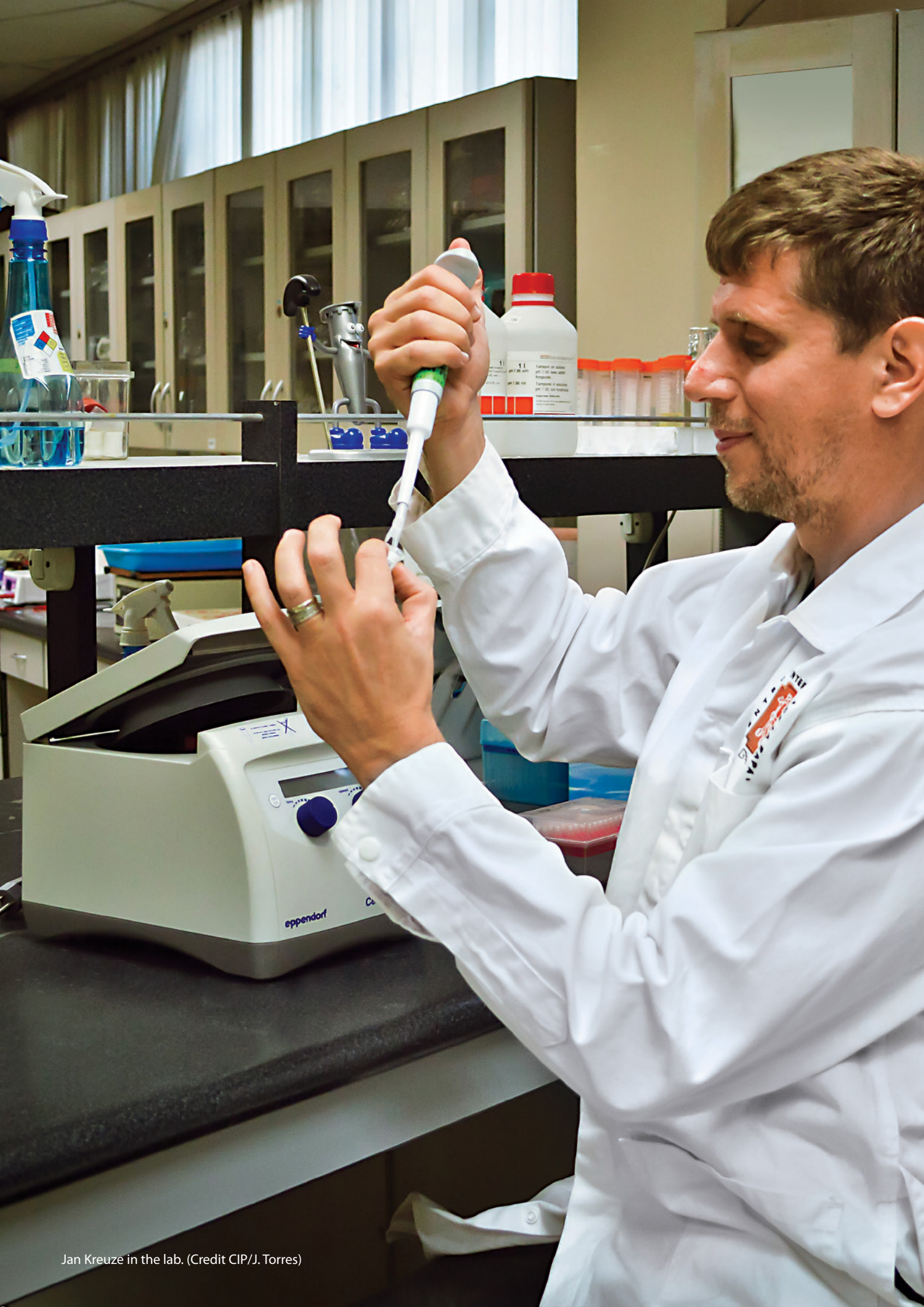
This annual report provides snapshots of how CIP and its many partners are contributing to the transformation of food systems globally. These include discoveries and scientific breakthroughs that have accelerated breeding and the development of diagnostic tools for crop diseases; innovations and knowledge disseminated to smallholder farmers to improve seed systems in Ethiopia and Kenya; and large-scale impacts on the nutrition and livelihoods of people across Africa and Asia.

All of these achievements have been made possible by the generosity of our funders, the dedication and passion of our staff and partners and our broad-based agri-food system collaborations. Two such partnerships were hugely significant for CIP in 2019: the CGIAR Research Program on Roots, Tubers and Bananas and the new CGIAR GENDER Platform. Both have given a multi-crop focus to our interventions and innovations and sharpened the gender lens of our work.

To rise to the urgent challenges that humanity faces, CIP is working to accelerate and strengthen the transition to a more cohesive, agile and responsive One CGIAR—one that will help create a more equitable, productive and environmentally-sustainable planet for future generations: to build back better and greener.

Barbara H Wells
Director General

Rodney Cooke
Chair, Board of Trustees



Jan Kreuze in the lab. (Credit CIP/J. Torres)

Discovery

Discovery

Climate-resilient, biodiverse agriculture

1 NO POVERTY

13 CLIMATE ACTION

Next-generation breeding

Genetic marker for late blight expedites breeding from 10 to 5 years

Potato improvement begins with crosses between breeding parents that produce tens of thousands of progeny. Scientists have traditionally spent years evaluating those plants in fields and greenhouses...

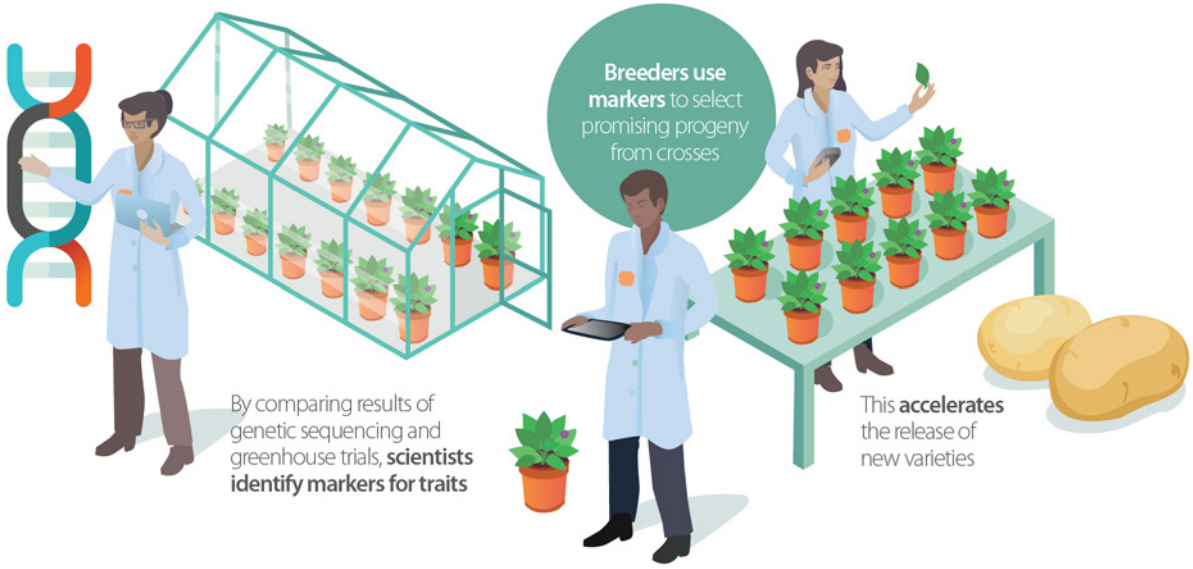
As the global population approaches 10 billion by 2050, agricultural production will need to increase by 60%. Yet with every 1°C of warming, agricultural productivity is projected to fall by 5%. One model predicts that potato yields could decrease by as much as 32% by 2060, but the development and distribution of climate-smart varieties can ensure that this nutritious and fast-maturing crop continues to play a vital role in food systems in economies worldwide.

To accelerate the development of those varieties, scientists have taken advantage of advances in genetic sequencing and are using the knowledge gained to breed potato varieties better suited to meet the demands of the future.

Scientists at the International Potato Center (CIP) have long been at the forefront of this trend, participating in the international group that published the first potato genome sequence in 2011. Thanks to recent breakthroughs involving the discovery of genes linked to important characteristics—from nutritional content to disease resistance—they have begun using genetic markers to speed up breeding for desired traits.

Accelerating potato improvement

Potato improvement begins with crosses between breeding parents that produce tens of thousands of progeny. Scientists have traditionally spent years evaluating those plants in fields and greenhouses, and eventually through male and female focus groups, in a process of elimination that results in a shortlist of potato clones with the greatest potential.



Research assistant Monica Santayana works on a project to crossbreed potato and its wild relatives. (Credit Crop Trust/M. Major)

The use of genetic markers for traits such as resistance to late-blight disease and the two most destructive potato viruses has accelerated CIP's progress in producing higher yielding potatoes. Whereas breeders once had to let all the progeny of a cross mature in a greenhouse to determine which ones were resistant, they now simply remove a leaf from each young plant for genetic sequencing to determine which ones inherited the resistance genes. The genetic marker for late blight resistance, for example, has cut the time this process takes by 50%.

Transferring resistance

Potato viruses accumulate and erode yields from one crop cycle to the next, whereas late blight can destroy a field of potato plants in a matter of weeks. When late blight-resistant varieties are grown widely for years, the pathogen evolves to overcome their resistance mechanism. So, breeders are always searching for new sources of resistance, frequently found in native or wild potatoes.

CIP recently crossbred with a wild potato native to Cajamarca, in northern Peru, to produce late-blight resistant potatoes that are potentially commercially viable. Shared with breeding partners in several countries, those potato clones are currently undergoing evaluation for possible release as varieties in Peru.

Since 1973, the CIP genebank has been collecting and preserving native and wild potatoes, many with resistance to late blight. As part of an international initiative to conserve, study, and use the genetic diversity of potato, tomato, eggplant and peppers—all of which are related—much of that biodiversity has been screened for disease resistance and undergone genetic sequencing in recent years.

The benefits of overcoming late blight cannot be understated. Estimates put annual global potato losses due to this disease at nearly USD 5 billion in 2019. Cutting into those losses with more resilient varieties can make an incredible difference for small-scale farmers, helping them transform their operations from subsistence to commercial.

With genetic markers, it becomes easier for breeders to develop resilient, high-yielding potatoes with the key traits —taste, texture, cooking time—sought by local consumers. The resulting varieties will enable farmers to meet the rising demand for food, improve their incomes, and cope with yet unforeseen challenges of a changing world.

Funders: Bill & Melinda Gates Foundation; CGIAR Coordinating Secretariat for Science Technology; European Union Funding for Research Innovation (Horizon 2020); Global Crop Diversity Trust; United States Agency for International Development.

Partners: International Crops Research Institute for the Semi-Arid Tropics; James Hutton Institute; Sainsbury Laboratory University of Cambridge; University of Wisconsin.

Associated CGIAR Research Programs or Platforms: Excellence in Breeding; Genebank; Roots, Tubers and Bananas.

Discovery

Food and nutrition security

2 ZERO HUNGER

Stopping sweetpotato pathogens

Taking virus detection out of labs and into farmer fields in Africa

"That this variety, which is resistant to the two most common sweetpotato viruses, could suffer that much damage from a third, underlines how much we need to learn," Kreuze said.

Pests and diseases cost the global agricultural sector an estimated USD 540 billion annually, and in developing countries, they cause potato and sweetpotato farmers to lose up to 60% of their yields.

Viruses can hinder the adoption of orange-fleshed sweetpotato varieties, which the International Potato Center (CIP) promotes as a sustainable source of vitamin A for families in Africa. Spread by whiteflies and aphids, those pathogens also pass from one crop generation to the next in planting material, diminishing the yields of each successive harvest.

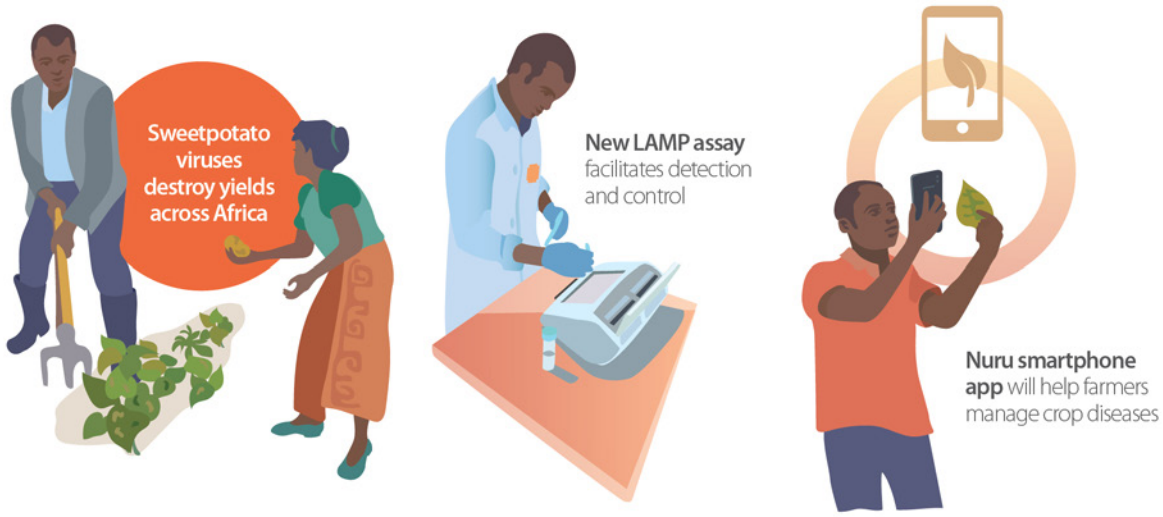
As viruses accumulate in plants, and yields decline, farmers may stop growing a nutritious sweetpotato variety, leaving their families at risk of vitamin A deficiency and the many health problems it causes.

Finding ways to manage sweetpotato viruses is thus a priority at CIP, where virologist Jan Kreuze has made recent scientific breakthroughs to develop technologies that could revolutionize disease control in Africa.

Deciphering viruses

Whereas human immune systems create antibodies to destroy viruses, plants have simpler defense responses that chop up a virus's genetic material—ribonucleic acid (RNA)—when it enters a cell, slowing its ability to cause damage.

Kreuze pioneered the use of genetic sequencing and reassembly of RNA fragments from a plant's anti-viral response to identify the



Scientist Barack Wanjawa tests the LAMP assay for sweetpotato viruses in Kenya. (Credit KALRO/A.Mulwa)

sweetpotato viruses that infect it. He led a field study that analyzed tissue samples from 1,168 sweetpotato plants in farmer fields across 11 African countries, identifying more than 15 viruses, some previously unknown.

The team then used the data to develop models to predict where specific viruses are likely to be found and how climate change will affect their distribution. They also identified genetic markers to develop a diagnostic field test for three common sweetpotato viruses using a technology known as a LAMP. The LAMP assay is vital because some infected plants are asymptomatic—like many people with COVID-19—which complicates detection.

The LAMP assay, which is faster and cheaper than laboratory-based methods, was tested at four different sites in Kenya and was 100% accurate. Though deployment was delayed by COVID-19, scientists expect the tool to be available soon in Kenya, allowing for the removal of infected planting material from seed systems and faster identification of virus-resistant varieties for farmers.

Diagnosis by phone

With the help of the assay, scientists are using photos of infected plants to develop the artificial intelligence to enable the smartphone app Nuru ("Light" in Swahili) to provide farmers with a real-time diagnosis of sweetpotato virus infections via their phones. Developed by CGIAR and Penn State University scientists, the app is part of a platform called Plant Village that also provides instructions on managing pests and diseases. Nuru has been used since 2018 to diagnose cassava and maize pests and diseases. Sweetpotato is one of a growing number of crops that it will provide diagnoses and advice for.

Both the app and LAMP assay are expected to help identify and control the most common viruses. But more work is needed to understand some previously unknown threats identified by Kreuze's team. In field trials they discovered that a group of common but asymptomatic viruses, known as begomoviruses, reduced yields of a popular orange-fleshed variety -- widely considered virus resistant -- by 40%.

"That this variety, which is resistant to the two most common sweetpotato viruses, could suffer that much damage from a third, underlines how much we need to learn," Kreuze said.

"By better understanding viruses, and improving diagnostic tools, we can help increase crop yields," he added. "This will put more nutritious food on the tables, and income in the pockets, of some of the world's most vulnerable families."

Funders: Bill & Melinda Gates Foundation; Biotechnology and Biological Sciences Research Council; European Union; The Howard G. Buffett Foundation; International Centre for Genetic Engineering and Biotechnology; The World Academy of Sciences, United Nations Educational, Scientific and Cultural Organization; National Science Foundation (US).

Partners: Boyce Thomson Institute; Donald Danforth Plant Science Center; Food and Agriculture Organization of the United Nations; Fera Science Limited; Kenya Plant Health Inspectorate Service; Penn State University.

Associated CGIAR Research Programs or Platforms: Roots, Tubers and Bananas.

Innovation

Ms Tirhas Woldu and her daughters, of Tigray, Ethiopia, enjoy orange-fleshed sweetpotato. (Credit CIP/A. Frezer)

Innovation

Food and nutrition security

2 ZERO HUNGER

Triple advantage

Climate-smart approach boosts farmer incomes by 14%

"My six children enjoy orange-fleshed sweetpotato very much," said Kuchuta, who explained that sweetpotato leaves and vines also serve as fodder for their cows in the dry season.

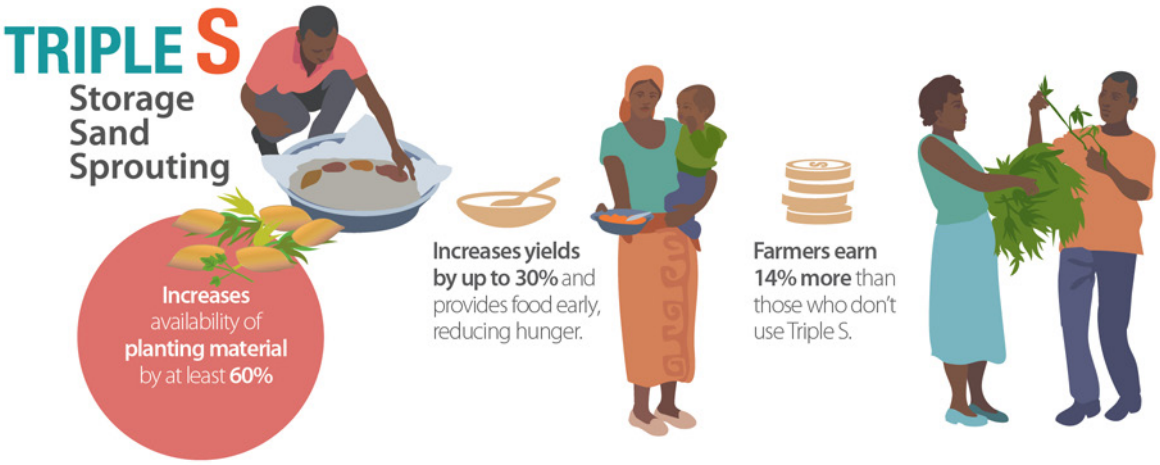
Like other farmers in Ethiopia's Southern Nations, Nationalities and Peoples Region (SNNPR), Worke Kuchuta stopped growing sweetpotato years ago after a prolonged drought made it impossible to find planting material in time for seasonal rains.

It's a common challenge in Africa, one that prevents many families from growing pro-vitamin A, orange-fleshed sweetpotato. But thanks to a simple innovation that enables her to produce quality planting material in a timely manner, Kuchuta and her family are now enjoying sweetpotato's nutritional benefits again.

Dealing with drought

Shortages of sweetpotato vines at the start of the rainy season force many farmers to plant late, or use low quality planting material, which result in late harvests and low yields. As climate change alters rainfall patterns, this is becoming increasingly problematic.

To address this challenge, the International Potato Center (CIP) and partners have promoted a system to store sweetpotatoes in sand during the dry months, plant them in seedbeds six weeks before the rainy season begins, and water them so that they sprout vines for planting once the rains resume. Dubbed Triple S (for storage in sand and sprouting) this appropriate technology allows farmers to start harvesting early in the year – when food is scarce and market prices are high – and increases the number of months families have sweetpotatoes to eat. Just 100 sweetpotatoes will sprout enough vines to plant in a quarter hectare, which can produce enough nutritious food to meet a family's annual vitamin A needs.



By storing sweetpotatoes in dry sand and using them to produce planting material, farmers are able to plant and harvest the nutritious crop earlier. (Credit CIP/M. Cherinet)

"My six children enjoy orange-fleshed sweetpotato very much," said Kuchuta, who explained that sweetpotato leaves and vines also serve as fodder for their cows in the dry season. In 2019, Kuchuta and her husband, Bezabih Hamamo, not only grew enough orange-fleshed sweetpotatoes to feed the family, they also sold a small surplus at a local market for USD 255, and sold vine cuttings to other farmers for additional income.

They are hardly an exception. One study found that farmers who use Triple-S earn 14% more than those who use traditional methods, which means it alleviates the financial burden of households that struggle to meet basic needs.

Taking an innovation to scale

Kuchuta and Hamamo are among the thousands of farmers in the SNNPR who are now producing their own planting material and growing orange-fleshed sweetpotato again. They are also showing other farmers how to implement Triple S, as they are among the hundreds of 'trainers' – farmers and government extension agents – who learned to teach their neighbors Triple S and good farming practices as a result of a gender-responsive initiative to take the innovation to scale. Supported by the CGIAR Research Program on Roots, Tubers and Bananas, the initiative used a combination of videos, printed materials, and demonstrations to teach nearly 14,000 Ethiopian farmers to use Triple S in 2018-19. In the process, it developed a methodology that can be used to take Triple S to scale elsewhere in the future.

The Triple-S scaling initiative also benefited farmers in northern Ghana, where CIP partnered with NGOs and the Ministry of Food and Agriculture to train approximately 37,000 farmers – 60 percent of them women – and show demonstration videos to another 43,000. By the end of 2019, instructors at five Ghanaian agricultural colleges had received training on Triple S, and approximately 500 trainers in Ethiopia and Ghana were ready to teach people the approach for years to come.

Triple-S – a fairly simple idea – demonstrates the power of an innovation and an effective approach for taking it to scale. With its eye squarely focused on the needs of poor farming families, CIP will continue to develop and disseminate such technologies and practices to improve nutrition, food systems and lives.

Funders: African Development Bank; Bill & Melinda Gates Foundation; European Union; Helen Keller International; Natural Resources Institute, United Kingdom; United States Agency for International Development.

Partners: CIRAD – Agricultural Research for Development; Adongo Agricultural College, Ghana; Digital Green, Ethiopia; Ghana Ministry of Food and Agriculture; Innovations for Sustainable Rural Development, Ghana; Integrated Water and Agricultural Development, Ghana; Mennonite Economic Development Association; People in Need; Savanna Agricultural Research Institute, Ghana; South Agriculture Research Institute, Ethiopia; Southern Nations, Nationalities, and Peoples' Region Bureau of Agriculture and Natural Resource Development; Partnership for Rural Development Action, Ghana; Tumu Deanery Rural Integrated Development Programme, Ghana; Sodo ATVET College, Ethiopia.

Associated CGIAR Research Program: Roots, Tubers and Bananas.

Innovation

Livelihood opportunities

1 NO POVERTY

Potatoes for prosperity

A quarter of Kenyan potato farmers adopt more productive varieties

Doris Kendo Gikunda, a potato farmer in Meru County, likes that Unica produces plenty of large tubers in just three months. "Unica is very good when cooked, and it has a ready market. People in towns who prepare chips love it," she said.

Africa's first potato farmers were European settlers who introduced the crop in the late 1800s, but few Africans grew it before the mid-1950s. Since then, the tuber has taken off, with more than 25 million metric tons produced in Africa in 2017.

In Kenya, potato is now the second most important food crop after maize, grown by 800,000 small-scale farmers and generating employment for an estimated 2.5 million people along the value chain. Improved potato production has the potential to significantly boost farm incomes. While reality for most Kenyan farmers had long fallen short of that potential, recently introduced disease-resistant and heat-tolerant varieties are giving farmers the upper hand.

Superior spuds

In Kenya, CIP partners with the Kenya Agriculture and Livestock Research Organization (KALRO) to meet farmer demands for more resilient and higher yielding potato varieties with the attributes sought by consumers.

One such potato is Sherekea. Released in 2010, Sherekea is now grown by one-fifth of potato farmers in Meru county—a major producing area—and nearly one in ten nationally. Breeders selected Sherekea for its yield potential and resistance to late blight, a disease that destroys an estimated 30–60% of Kenya's potato crop annually.

Climate-resilient Unica, another CIP variety released in 2016, thrives in both highlands and lowlands, rainy and dry areas, and resists viruses and late blight. Because Unica tolerates heat and water stress, it has been promoted in traditional and non-traditional potato producing areas, such as Meru and

Farmer Doris Kagendo Gikunda, of Meru County, with the high-yielding CIP potato variety Unica. (Credit CIP/V. Atakos)

Tanita-Taveta counties. It is as productive as other varieties on less than a third of the rainfall.

Doris Kendo Gikunda, a potato farmer in Meru County, likes that Unica produces plenty of large tubers in just three months. "Unica is very good when cooked, and it has a ready market. People in towns who prepare chips love it," she said.

Sustainable seed systems

Because potato has a lower multiplication rate than grain crops, it can take up to 10 years to produce enough seed potatoes of a new variety for a sufficient number of farmers to start growing it. With the introduction to Kenya of new techniques like using rooted cuttings from potato plants as starting material, and training for small-scale seed multipliers and larger companies, the production of quality planting material has significantly accelerated in recent years.

This has been facilitated by public-private partnerships involving KALRO and a dozen seed companies, which have made seed production a more profitable activity and ensured the sustainability of the system. Thanks of these collaborations, a combination of parastatal and private sector enterprises now produce about 2 million metric tons of potato seed per year – five times what was available to farmers a decade ago – sold for about USD 2 million. In exchange for the rights to sell the varieties, KALRO receives 2.5% royalty of seed sales. The money raised helps fund the breeding of future varieties.

Kisima Farm, Kenya's biggest seed producer, has scaled back production of Asante – until recently one of the country's top varieties – to produce more Sherekea seed, which has become the company's biggest seller. "Sherekea is now widely recognized as giving higher yields and being more late blight-resistant than Asante," noted Jonathan Moss, Kisima Farm's managing director.

Thanks to research and technical support over the last five years, NGOs and county governments have set up local systems to produce and disseminate quality seed to small-scale farmers more quickly. Consequently, nearly a quarter of Kenya's potato farmers, some 180,000, now grow CIP-bred varieties. And since planting quality seed of improved varieties boosts yields, decision makers have taken notice.

"Our work has really opened the eyes of local leaders to the potential value of potato," said senior scientist Monica Parker. "Over the last five years, more than 200 extension agents from nine county governments have trained farmers in the use of apical cuttings to produce seed potatoes, while CIP provided technical support to large seed producers, which led to at least 15 nurseries in Kenya investing in apical cutting production. This will accelerate the dissemination of the improved varieties and greater availability of quality potato seed in the coming years."

Funders: Deutsche Gesellschaft for Internationale Zusammenarbeit; Syngenta Foundation for Sustainable Agriculture; United States Agency for International Development.

Partners: Aroma; Farm Input Promotions Africa; Genetic Technologies International Limited; Kenya county governments of Bungoma, Elgeyo-Marakwet, Kiambu, Meru, Nakuru, Nandi, Nyandarua, Taita Taveta, and Uasin Gishu; Kisima Farm; Self Help Africa; Stokman Rozen Kenya; Taita Papa; Potato Empire; World Food Programme.

Associated CGIAR Research Programs: Roots, Tubers and Bananas.

Impact

A combination of sweetpotato planting material, agronomic training and nutrition education has helped millions of rural families improve their food and nutrition security. (Credit CIP/I. Corthier)

Sweet resilience

Sweetpotato helps communities bounce back from humanitarian crises

Farmers in the provinces pummeled by Cyclone Idai were on the road to recovery in record time because CIP had been working there since 2014 through a project called "Scaling up sweetpotato through agriculture and nutrition."

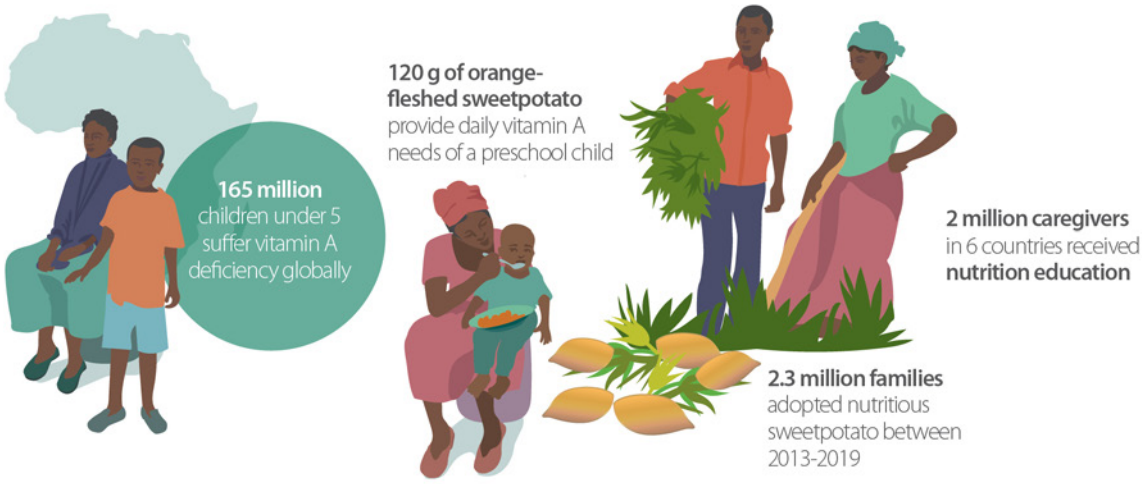
In March 2019, Cyclone Idai barreled across central Mozambique whipping winds at 170 km per hour and unleashing torrential rains that wiped out 700,000 hectares of crops, left more than 1,000 dead, and caused USD 2 billion of damage in Malawi, Mozambique and Zimbabwe.

Within weeks of that disaster, the International Potato Center (CIP) partnered with the International Committee of the Red Cross to distribute 40 metric tons of sweetpotato planting material in the Mozambican provinces of Sofala and Manica, to help 7,500 smallholder farmers get back on their feet quickly and increase the availability of a nutritious, fast-growing food crop.

"There is no other crop as good as sweetpotato for post emergency recovery," said Maria Andrade, CIP country manager in Mozambique.

Andrade explained that the planting material distributed was locally adapted orange-fleshed sweetpotato, just 120 grams of which provide the vitamin A needs of a five-year-old child. This is an invaluable trait in Mozambique, where 69% of children suffer vitamin A deficiency, which compromises their immune systems and causes some to go blind. Within two months of planting, families were able to begin eating vitamin-rich sweetpotato leaves, and within three months, they were harvesting nutritious, calorie-packed sweetpotatoes to eat and sell.

Andrade's team liaised with local authorities to ensure that an additional 20 metric tons of vines were planted and multiplied for distribution two months later, when floods receded and lowlands could be farmed again, which benefited another 4,000 resource-poor farming families. They also worked with specialized farmers known as vine multipliers—who grow



Thousands of farmers received sweetpotato planting material to replace crops destroyed by Cyclone Idai. (Credit CIP/I. Corthier)

sweetpotato vines to produce cuttings for sale—to restart the planting material supply chain.

Building on success

Farmers in the provinces pummeled by Cyclone Idai were on the road to recovery in record time because CIP had been working there since 2014 through a project called "Scaling up sweetpotato through agriculture and nutrition" (SUSTAIN). That initiative trained more than 90 vine multipliers and promoted the crop widely in Mozambique.

As part of SUSTAIN, nearly 300,000 Mozambican farming families with children under five received planting material for nutritious sweetpotato and training on how to grow the crop. At the same time, local government and NGO partners provided gender-responsive nutrition education—with an emphasis on orange-fleshed sweetpotato— to more than 200,000 caregivers between 2013 and 2019.

When farmers harvested the first post-cyclone sweetpotatoes, there was a strong market ready to buy them, thanks to years of promotional campaigns, agronomic training, cooking classes and the use of orange-fleshed sweetpotato puree by bakeries and other food processors. The promotion and education resulted in a growing number of Mozambicans who cultivate and consume orange-fleshed sweetpotato—a crop that was rare in the country just 15 years earlier.

"I can guarantee that if you ask people here about orange-fleshed sweetpotato, 90% are familiar with it and they know it is good for children," Andrade said.

That awareness has spread from farms and markets to government offices. Orange-flesh sweetpotato is now a priority crop promoted by federal ministries and provincial directorates of agriculture and health, and a range of civil society organizations. Such buy-in reflects growing recognition that a combination of planting material distribution, agricultural training, nutrition education, and market building can improve food security, vitamin A uptake and incomes.

International impacts

SUSTAIN achieved impressive results in Bangladesh, Kenya, Malawi, Rwanda, Tanzania and Mozambique, reaching 2.3 million households with children under five with nutritious sweetpotato and 2 million people with nutrition education.

This investment has not only reduced the risk of hunger and vitamin A deficiency in vulnerable communities, it has also boosted their resilience.

In the years ahead, unpredictable climate-induced and other disasters are bound to threaten developing countries. In those situations, sweetpotato is uniquely positioned to provide quick, affordable food, nutrition, and long-term sustainability for resource-poor farming families around the world.

Funders: Department of International Development, United Kingdom

Partners: BRAC, Bangladesh; Concern Worldwide; Feed the Children; Governo de Moçambique; IMBARAGA Farmers Organisation; Instituto de Investigação Agrária de Moçambique; Michigan State University; PATH; Rwanda Agriculture Board; Secretariado Técnico de Segurança Alimentar e Nutricional; Servicio Distrital de Actividades Económicas de Manica; Young Women's Christian Association.

Associated CGIAR Research Program: Agriculture for Nutrition and Health; Roots, Tubers and Bananas.

Climate-resilient, biodiverse agriculture

1 NO POVERTY

13 CLIMATE ACTION

Asian appetites

Nearly 3 million farmers embrace CIP-bred potatoes, raising revenues and resilience

CIP's collaboration with Asian partners continues to result in new varieties. An example is Kufri Lima, a heat-tolerant and virus-resistant potato bred at CIP headquarters in Peru and released in India in 2018.

Rising investment in infrastructure, people and research across Asia over the last 20 years has produced dramatic improvements in living standards. Nowhere is this more visible than the agricultural sector, where crop yields have grown six-fold in China and two-fold in India over the last 40 years.

Rising potato production has played its part in growing farm incomes and more diverse diets. Over the last 10 years, potato production in seven Asian countries—Bangladesh, China, India, Indonesia, Nepal, Pakistan and Vietnam—has risen by more than 50%, while the value of farmgate sales have more than doubled to nearly USD 37 billion per year.

Decades of success

An assessment published in 2018 found that 19% of the total land area devoted to potato production in these seven countries was planted with varieties bred at the International Potato Center (CIP) or by national partners in collaboration with CIP. Between 2008 and 2015, the area planted with those varieties more than doubled to 1.43 million hectares. Over the past 40 years, CIP scientists have helped 2.93 million potato farming households overcome challenges such as limited land and climate change to produce more food and generate more income, while diversifying the diets of rural and urban consumers.

The Chinese variety Cooperation-88 (C88) is one success story. The result of collaboration between CIP and Yunnan Normal University, C88 was growing on more than 160,000 hectares by 2015. A follow-up analysis found that C88's cumulative value for farmers and consumers in Yunnan Province alone was approximately USD 2.84-3.73 billion.

C88 and five other CIP-related potato varieties together constitute about a quarter of the potatoes grown in China. Those six and dozens of other CIP-related varieties have been successful in Asia thanks to a combination of disease resistance, adaptability to challenging climates and environments, and characteristics that local consumers want. They include early-maturing potatoes that are key to recent work on sustainable intensification, which enables farmers to grow more food on the same amount of land with fewer inputs.

New varieties

CIP's collaboration with Asian partners continues to result in new varieties. An example is Kufri Lima, a heat-tolerant and virus-resistant potato bred at CIP headquarters in Peru and released in India in 2018. Because Kufri Lima is ready to harvest 80-90 days after planting, it is ideal for sustainable intensification, able to be grown between rice crop cycles on land that would otherwise be fallow.

In 2019, the Potato Technology Centre Shamgarh Karnal, in Haryana, began using cutting-edge technologies to produce enough seed potatoes to allow thousands of farmers to start growing this new variety.

"We expect that Kufri Lima will be popular for both fresh consumption and processed markets, and are hopeful it will help to transform the potato economy in India," said Anand Kumar Singh, Deputy Director General for Horticulture at the Indian Council of Agricultural Research.

Singh added that he hopes Kufri Lima will be as successful as Kufri Chipsona-1, a disease-resistant variety bred by Indian scientists using CIP germplasm and released in 1998. Thanks to strong market demand, Kufri Chipsona-1 is now grown on approximately 60,000 hectares, and farmers in Uttar Pradesh have reported earning 30% more with this variety.

The potato's power to boost incomes and resilience in Asia will continue to grow in the coming decade, as new climate-smart varieties are taken to scale. These include Kufri Lima and several new heat- and salt-tolerant varieties being grown in Bangladesh, where a cyclone storm surge left coastal farmlands too saline for most crops. As CIP and partners produce other high-yielding varieties suited to such conditions, more and more farmers across the region will use the humble potato as a tool to overcome the challenges of today and the unforeseen ones that lie ahead.

Women evaluate potato varieties in Barpeta, India. (Credit CIP/ D. Elango)

Funders: Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, Germany; Government of the Grand Duchy of Luxembourg; Rural Development Administration, Republic of Korea; Syngenta Foundation for Sustainable Agriculture; United States Agency for International Development.

Partners: Bangladesh Agricultural Research Institute; Central Potato Research Institute/Indian Council of Agricultural Research; Chinese Academy of Agricultural Sciences; Ganzu Agricultural University, China; Hebei North University, China; Heilonjiang Academy of Agricultural Sciences, China; HZPC Holding BV; Indonesian Agency for Agricultural Research and Development; Ministry of Agriculture and Rural Development, Vietnam; National Institute of Crop Science, Republic of Korea; Nepal Agricultural Research Council; Potato Technology Centre Shamgarh Karnal, India; Potato, Vegetable and Flower Research Center, Vietnam; Tajikistan Academy of Agricultural Sciences; Qinghai Academy of Agriculture and Forestry Sciences, China; Yunnan Normal University, China; Vietnam National University of Agriculture; Uzbekistan Academy of Sciences.

Associated CGIAR Research Programs or Platforms: Excellence in Breeding; Roots, Tubers and Bananas.

CIP in CGIAR

CGIAR is a global partnership that unites organizations engaged in research for a food secure future. With 15 centers around the world, CGIAR is dedicated to reducing rural poverty, increasing food security, improving human health and nutrition, and ensuring more sustainable management of natural resources. Tackling these challenges, which are at the heart of the United Nations Sustainable Development Goals, requires research to identify state-of-the-art solutions and effective partnerships to deliver them.

The CGIAR Research Portfolio is structured around two interlinked clusters of challenge-led research programs: agri-food systems and global integrating programs. CIP leads the agri-food system CGIAR Research Program on Roots, Tubers and Bananas and participates in several global integrating programs. CIP also works closely with the CGIAR research support platforms.

CGIAR Research Programs

Roots, Tubers and Bananas

Led by CIP

- Genetic resources
- Productive varieties and quality seed
- Resilient crops
- Nutritious food and added value
- Improved livelihoods at scale

Policies, Institutions and Markets

Led by IFPRI

- Technological innovation and sustainable intensification
- Inclusive and efficient value chains
- Social protection for agriculture
- Gender research

Climate Change, Agriculture and Food Security

Led by CIAT

- Priorities and policies
- Climate-smart technologies and practices

Agriculture for Nutrition and Health

Led by IFPRI

- Food systems for healthier diets
- Biofortification

CGIAR Platforms

Big Data

Led by CIAT

- Data generation, access and management
- Big data and agricultural development
- Big data analytics

Genebank Platform

Led by Global Crop Diversity Trust

- Conservation, use and policy
- Quality management, Information systems
- Germplasm health

Excellence in Breeding

Led by CIMMYT

- Product design and management
- Genotyping and phenotyping tools and services
- Bioinformatics, biometrics and data management

Gender Platform

Led by ILRI

- Research to inform food system development
- Methodologies to achieve gender equality
- Alliances to strengthen outcomes

CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute

Our powerhouse crops

Potato

A potato contains about half the daily adult requirement of vitamin C and significant amounts of zinc, iron, potassium, and vitamin B.

China is the world's largest producer, harvesting more than 73 million tons of potato a year.

More than a billion people worldwide eat potato as a staple food.

Potato can grow in almost any climate, from sea level to about 4,000 meters above sea level.

There are 5,000 different varieties of potato in CIP's genebank, half of them can only be found in Peru.

Potato is the third most important food crop after rice and wheat and produces more calories per hectare than either of those grains.

Potato produces more food per unit of water than any other major crop.

Sweetpotato

Just 125 g of fresh orange-fleshed sweetpotato contains enough beta carotene to provide the daily vitamin A needs of a preschool-aged child. The crop is also a valuable source of vitamins B, C, and E.

Sweetpotato is also a healthy, cheap animal feed. Studies suggest that livestock fed on sweetpotato vines produce less methane, meaning its use could potentially mitigate global warming.

More than 105 million tons are produced globally each year, with 95% in developing countries.

Worldwide, sweetpotato is the sixth most important food crop after rice, wheat, potato, maize and cassava, but it ranks fifth in developing countries.

Sweetpotato is a storage root, not a tuber like the potato.

Sweetpotato can grow at altitudes from sea level to 2,500 meters above sea level, and comes in varieties ranging in color from white to yellow, orange or purple.

Credit CIP/I. Corthier

CIP at a glance

CIP operations

LATIN AMERICA AND THE CARIBBEAN

Bolivia
Ecuador
Guatemala
Haiti
Peru

AFRICA

Cameroon
Eswatini
Ethiopia
Ghana
Kenya
Madagascar
Malawi
Mali
Mozambique
Nigeria
Rwanda
South Africa
Tanzania
Tunisia
Uganda

ASIA

Bangladesh
China
Georgia
India
Philippines
Vietnam

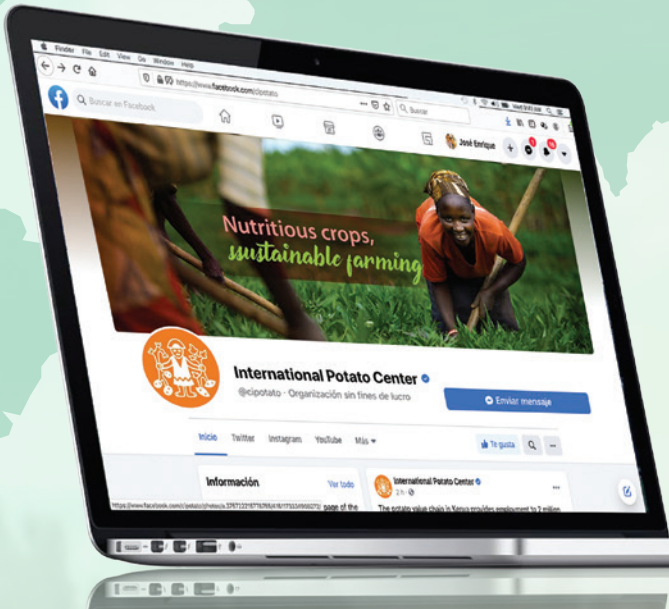
Headquarters and regional office

Peru

Credit CIP/H. Rutherford

Communication data 2019

https://cipotato.org/



CIP's WEBSITE

USERS ▶ 336,058 Increase 27 %

VIEWS ▶ 778,903 Increase 17 %

SOCIAL MEDIA OUTREACH

	REACH*	ENGAGEMENT*	FOLLOWERS
	1,266,552	▶ 72,140	18 %
	2,953,801	▶ 45,849	30 %
	---	▶ 2,458	55 %
	110,046	▶ 4,822	1.4 %

*Individuals reached and numbers who engaged with CIP posts

MEDIA OUTREACH

REACH

2019 ▶ CIP media engagement in the media reached **1.6 billion**

208%

ADVERTISING VALUE EQUIVALENT

2019 ▶ **USD 14.7 million**

208%

REPOSITORIES

71,457 Documents downloaded

256%

3,076 Datasets downloaded

317%

PUBLICATIONS

TOTAL ▶ **250**

154%

Open access: 224

3%

ISI journal articles: 78

36%

Credit CIP/S. Quinn

Social reach of scientific publications

2019 marked an outstanding year for CIP's contribution to scientific knowledge as CIP scientists authored (or co-authored) 80 papers published in 66 different journals, nearly all of which are internationally recognized. In keeping with CIPs mandate to serve the public good, 56 of those articles (70%) are open access, freely available to all readers. The Altmetric scores below reflect not only the quality of the research but its relevance in on-going discussions in mass media, social media and public policy documents.

CIP publications are available to the public in CGSpace, the CGIAR's research repository.

TOP 5

Altmetric scores

The origins and adaptation of European potatoes reconstructed from historical genomes
Nature Ecology & Evolution
https://hdl.handle.net/10568/102100

Crop variety management for climate adaptation supported by citizen science
Proceedings of the National Academy of Sciences of the United States of America
https://hdl.handle.net/10568/99504

The new potato
Science
https://hdl.handle.net/10568/99352

A taxonomic monograph of Ipomoea integrated across phylogenetic scales
Nature Plants
https://hdl.handle.net/10568/106083

Understanding the consequences of changes in the production frontiers for roots, tubers and bananas
Global Food Security
https://hdl.handle.net/10568/100098

Mentioned in

- News outlets
- Blogs
- Twitter
- Facebook
- Wikipedia
- Google+
- Reddit
- Video

Citations

- Dimensions

Readers on

- Mendeley

Funders in 2019

The International Potato Center gratefully acknowledges the countries, organizations, partners and individuals that supported its agricultural research for development in 2019. We also thank all the funders that globally support our work through their contributions to the CGIAR system.

- 2BLADES Foundation
- African Agriculture Technology Foundation
- African Development Bank
- Agencia Española de Cooperación Internacional
- American Institutes for Research
- Australian Centre for International Agriculture Research
- Austrian Development Cooperation
- Bill & Melinda Gates Foundation
- Biotechnology and Biological Sciences Research Council
- CGIAR Genebank Platform
- CGIAR Platform for Big Data in Agriculture
- CGIAR Research Program on Climate Change, Agriculture and Food Security
- CGIAR Research Program on Policies, Institutions, and Markets
- CGIAR Research Program on Roots, Tubers and Bananas
- CGIAR Trust Fund
- Compañía Minera Poderosa S.A.
- Department for International Development, United Kingdom
- Deutsche Gesellschaft für Internationale Zusammenarbeit
- European Commission
- Food and Agriculture Organization of the United Nations
- Gansu Agricultural University
- Global Challenges Research Fund
- Global Crop Diversity Trust
- Government of China
- Government of India
- Government of the Federal Republic of Germany
- Harvest Plus
- International Center of Insect Physiology and Ecology
- International Development Research Center
- International Food Policy Research Institute
- International Fund for Agricultural Development
- International Maize and Wheat Improvement Center
- Irish Aid
- McCain Foods Limited
- McKnight Foundation
- McLaughlin Gormley King Company
- Ministry of Agriculture and Irrigation, Peru
- Norwegian Development Cooperation
- Organization of the Petroleum Exporting Countries Fund for International Development
- Programa Nacional de Innovacion Agraria, Peru
- RTI International
- Rural Development Administration, Republic of Korea
- State government of Haryana, India
- State government of Odisha, India
- Swiss Agency for Development and Cooperation
- Syngenta Foundation for Sustainable Agriculture
- United States Agency for International Development
- World Bank Group

Finances

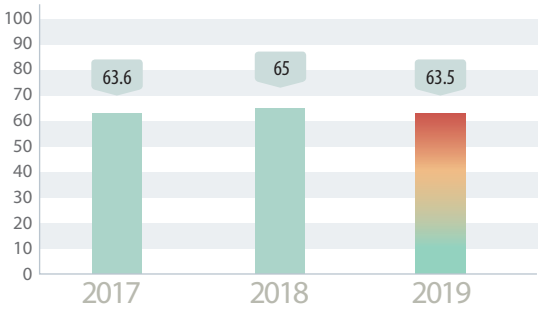
As a CGIAR research center, much of CIP's research is conducted through CGIAR Research Programs. Funding for those programs, and for bilateral projects, comes from public and private organizations, governments and foundations across the globe. The Center also receives generous in-kind support from national partners and international collaborators.

CIP gratefully acknowledges the countries, organizations, partners and individuals that supported its agricultural research for development in 2019. CIP also thanks all the funders that globally support its work through their contributions to the CGIARcomandocomando system. Without their intellectual and financial support, CIP could not have made the contributions to better lives reported here.

Total revenue and expenses reported by CIP in 2019 were USD 63.5 and USD 65 million respectively, reflecting a deficit of USD 1.5 million. On 31 December 2019, CIP's reserves were USD 15.2 million, representing 82 days of expenditure – within CGIAR norms – compared to USD 16.7 million (92 days) on 31 December 2018.

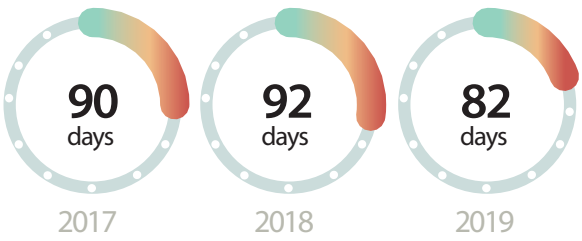
CIP's full financial report for 2019 is available online.

Revenue



USD **63.5** million

Liquidity and financial stability



82 days

reserves

Governance and leadership

Board of trustees

Rodney Cooke (UK), Chairperson; Independent consultant in agriculture and rural development
Barbara H. Wells (USA), Member Ex-Officio; Director General of the International Potato Center

Jose Alberto Barrón Lopez* (Peru), Trustee; Instituto Nacional de Innovación Agraria, Peru
Andrés Casas (Peru), Trustee; Universidad Nacional Agraria La Molina
Linley Chiwona-Karltun (Sweden/Malawi), Chair of the Governance Committee; Swedish University of Agricultural Sciences
Esteban Chong (Peru), Trustee; Universidad del Pacifico
Qu Dongyu* (China), Trustee; Ministry of Agriculture of the People's Republic of China
Jim Eckles (USA), Chair of the Program Committee; the Context Network
Jorge Luis Maicelo Quintana (Peru),** Trustee; Instituto Nacional de Innovacion Agraria
Patrick J Murphy* (USA), Chair of the Audit and Risk Committee; International Fertilizer Development Center and HarvestPlus
Rhoda Peace Tumusiime (Uganda), Trustee; African Union Commission
Vo-Tong Xuan* (Vietnam), Trustee; Nam Can Tho University

Leadership

Management committee

Barbara H. Wells, Director General
Oscar Ortiz, Deputy Director General for Research and Development

Paul Demo, Regional Director for Africa
Michael Gerba*, Chief Operating Officer
Selim Guvener, General Counsel
Carla Lazarte, Director of People and Organizational Development
Xiaoping Lu, Deputy Director General of CIP and Director of CIP China Center for Asia Pacific Region
Luis Felipe Mendes*, Chief Financial Officer
Samarendu Mohanty, Regional Director for Asia
Amalia Perochena, Chief of Staff
Michelle Rodrigo,** Head of Project Award and Implementation
Amanda Rodriguez,** Chief Financial Officer
James Stapleton, Head of Communications
Ginya A. Truitt Nakata,** Regional Director for Latin America and the Caribbean
Pietro Turilli, Director of Resource Mobilization

Science leaders

Oscar Ortiz, Deputy Director General for Research and Development
Hugo Campos, Research Director

Maria Andrade,** Leader for Sweetpotato Breeding in Africa
Noelle Anglin, Head of the Genebank
Ian Barker,** Potato Program Leader
Guy Hareau, Social and Nutritional Sciences Leader
Simon Heck, Sweetpotato Program Leader
Jan Kreuze, Crop and Systems Science Division Leader
Jan Low, Principal Scientist
John Schoper*, Genetics, Genomics and Crop Improvement Sciences Division

* Left in 2019
** Joined in 2019

www.cipotato.org

CIP is a research-for-development organization with a focus on potato, sweetpotato and Andean roots and tubers. It delivers innovative science-based solutions to enhance access to affordable nutritious food, foster inclusive sustainable business and employment growth, and drive the climate resilience of root and tuber agri-food systems. Headquartered in Lima, Peru, CIP has a research presence in more than 20 countries in Africa, Asia and Latin America.
www.cipotato.org

CIP is a CGIAR research center
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.
www.cgiar.org

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