WORLD COFFEE RESEARCH™

ANNUAL REPORT **2017**

Creating the future of coffee

TABLE OF CONTENTS

ABOUT THIS REPORT

This report covers World Coffee Research activities, highlights and results for the period from January 1, 2017 to December 31, 2017.

WHO WE ARE

World Coffee Research is the only organization in the world applying advanced agricultural science for coffee on a world-wide, collaborative basis. World Coffee Research enables the global coffee industry to invest in advanced agricultural R&D to transform the coffee sector.

A collaborative, not-for-profit research organization, we were formed by the global coffee industry in 2012, recognizing that transforming coffee growing into a profitable, sustainable livelihood that can meet rising demand by coffee drinkers while also safeguarding natural resources necessarily requires innovation in coffee agriculture.

MISSION

To grow, protect, and enhance supplies of quality coffee while improving the livelihoods of the families who produce it.

WHAT WE DO

Together with our partners, we use advanced and applied research in the areas of **breeding, genetics and genomics, agronomy, phytopathology, sensory and chemistry science,** and **socioeconomics** to create new technologies and market opportunities for farmers to become more resilient and profitable, especially in the face of significant threats like climate change and pests and diseases.

World Coffee Research is preparing the next generation of high yielding, resilient coffee varieties. In addition, World Coffee Research is conducting the first global research to drive profitable agricultural practices, minimize inputs and environmental impacts, and maximize farmer income.

IMPACT

Using advances in agricultural science, it is possible to dramatically improve coffee yields, coffee quality, climate resilience, and farmer livelihoods.

Our globe-spanning research is designed to deliver:

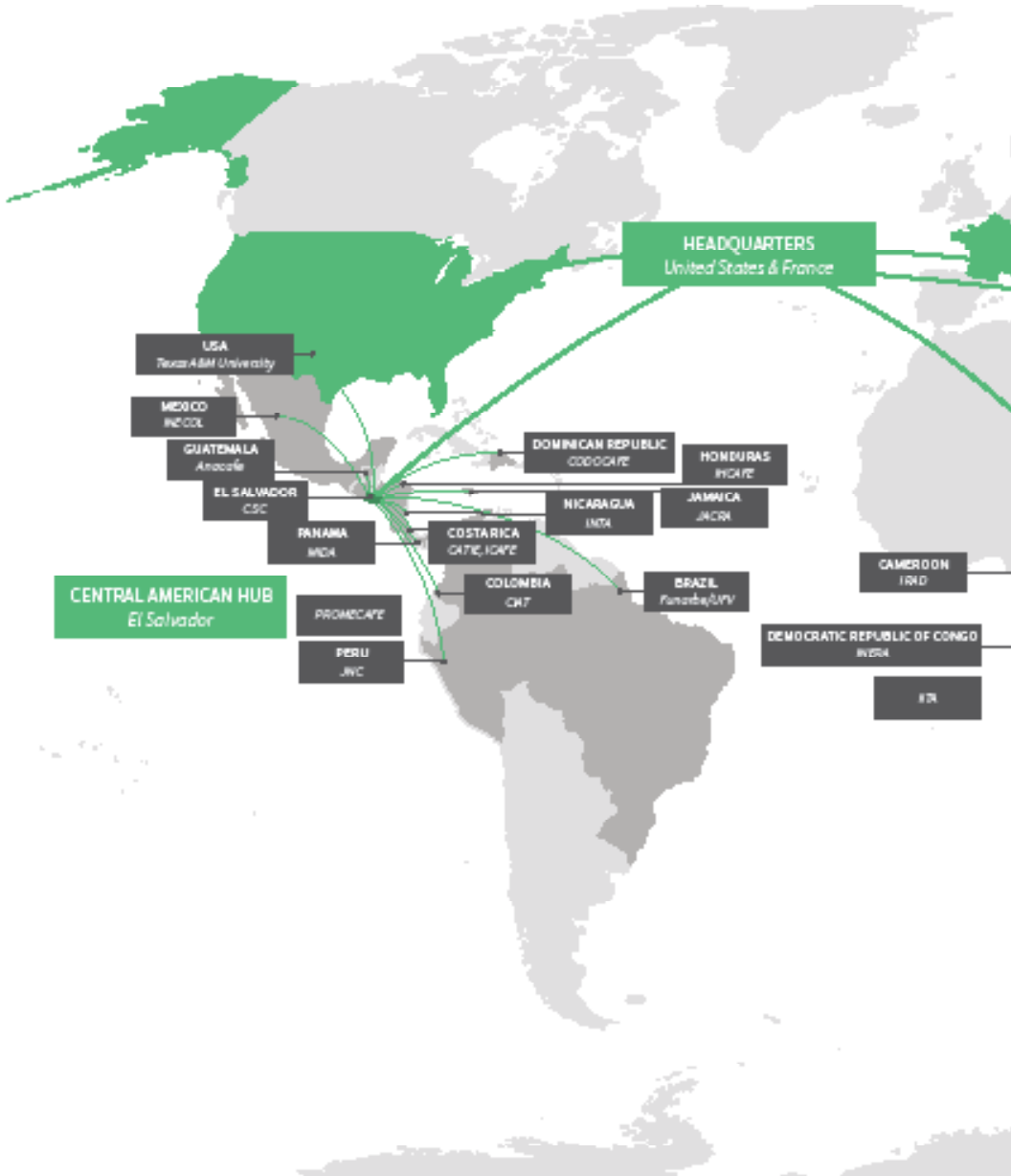
- **Higher quality coffee**
- **More productive coffee farms**
- **Higher profits for farmers**

COLLABORATIVE, OPEN, GLOBAL

OUR PARTNERSHIP APPROACH

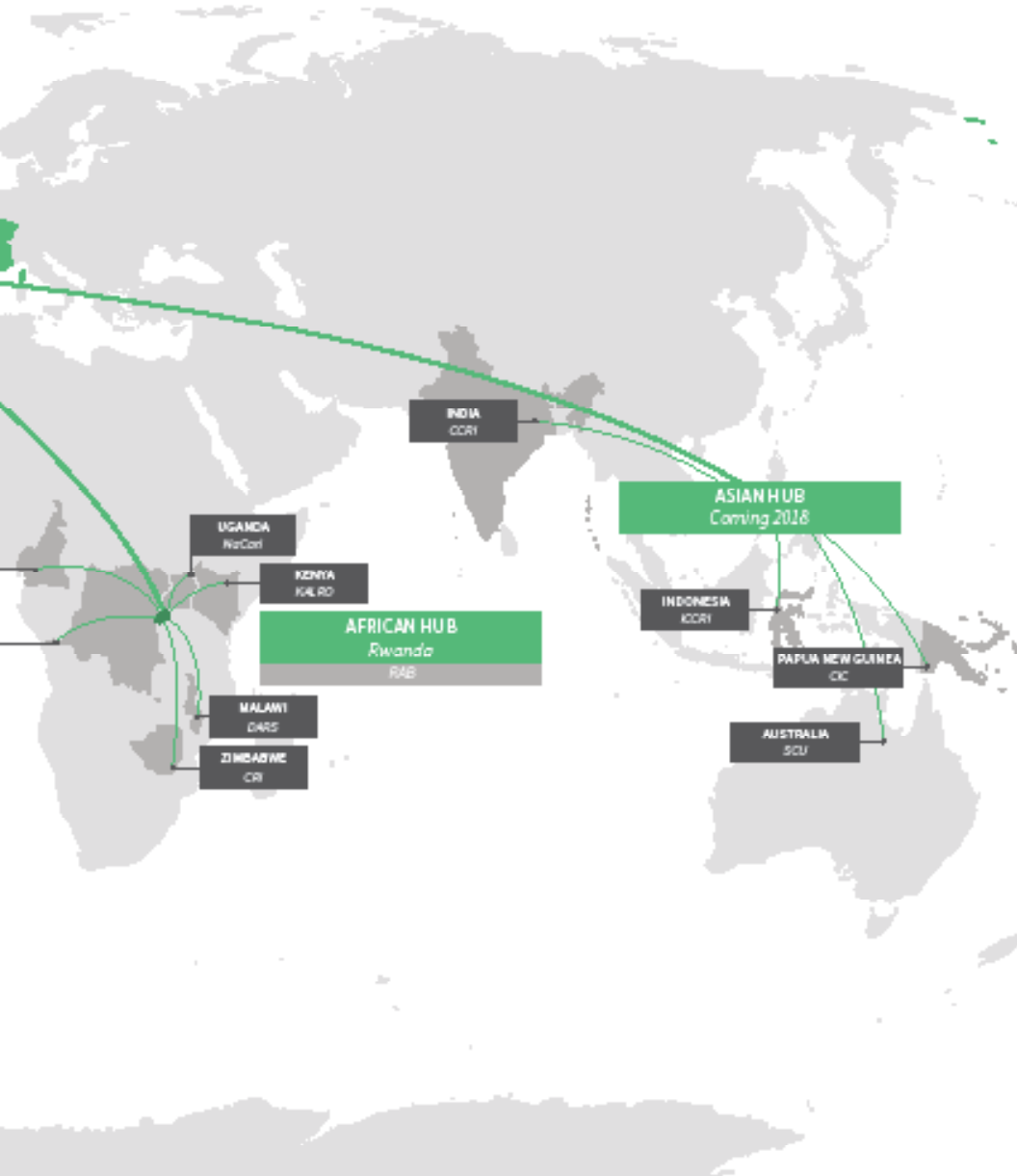
We rely on deep collaboration with local research institutions, coffee organizations, governments, and NGOs to carry out our ambitious research agenda and to ensure maximum impact.

In each country, we begin with the national coffee institute or organization to align our work



to their strategy; together, we agree on research activities that World Coffee Research and the country can undertake collaboratively.

Our research partners: **69** partners, including **28** government institutes and research organizations.

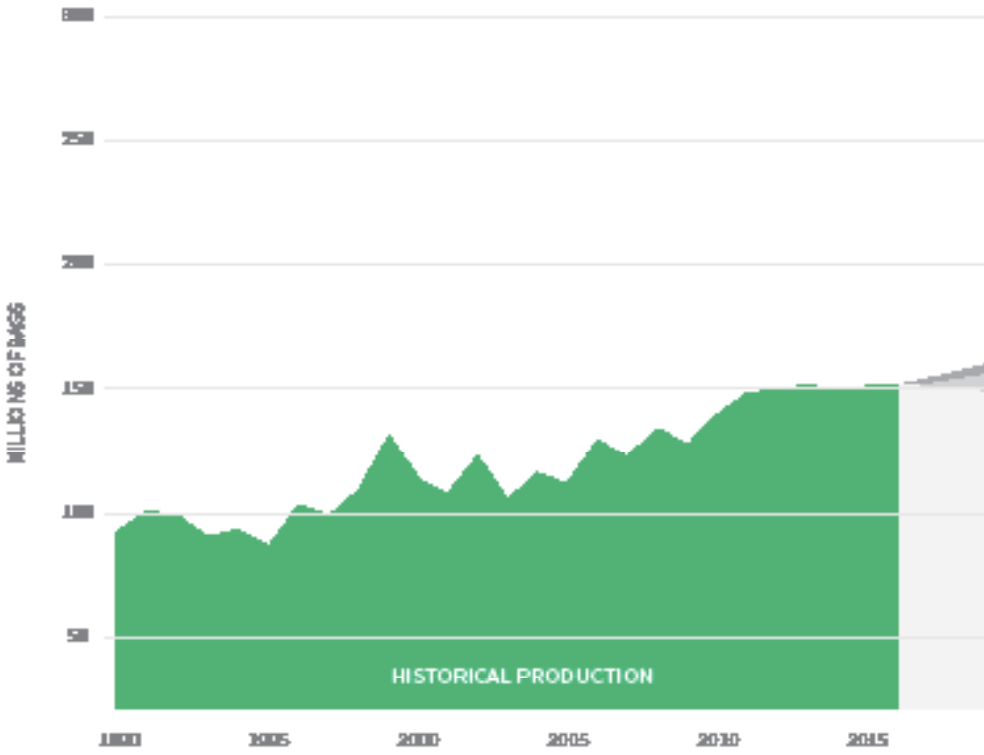


ACCELERATING RESEARCH TO CLOSE THE GAP

COFFEE'S SCIENCE GAP

Without rapid action, the coffee sector will need 60 to 180 million more bags of coffee in 2050 than we are likely to have.

This is coffee's science gap—the gap that coffee agricultural R&D will need to address though a vigorous focus on climate-resilient varieties and climate-smart agriculture.



Historical production

Since the 1990s, consumption and production have increased by an average of 2.1%. The increase has come almost exclusively from Brazil and Vietnam.

What we will need

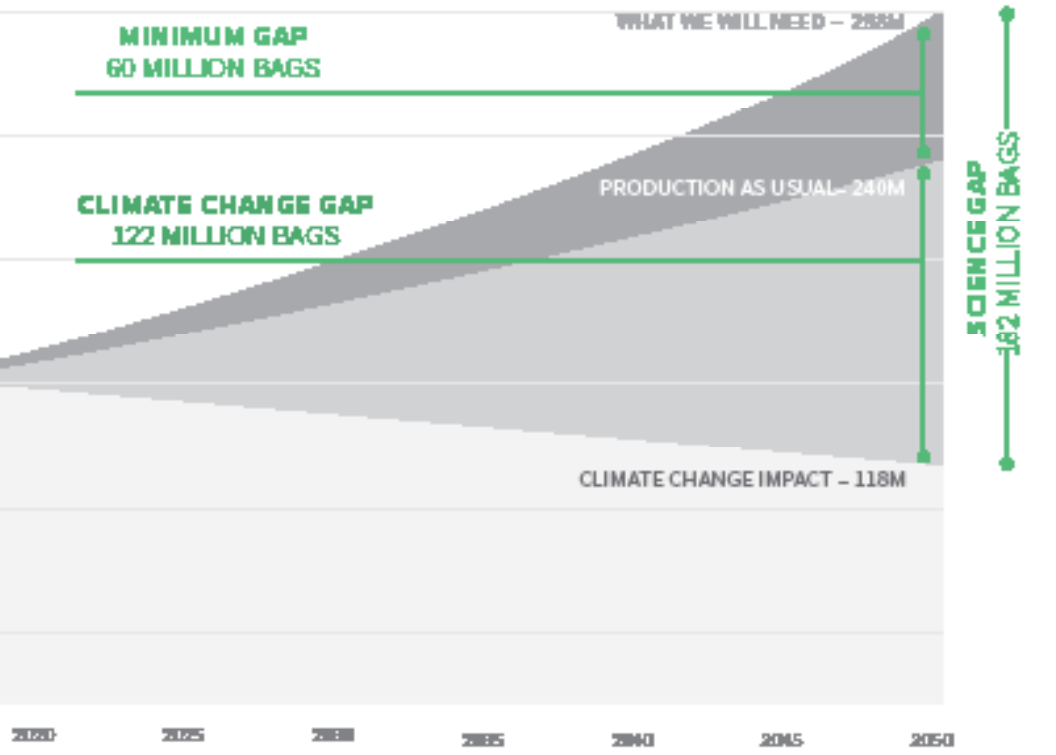
If coffee consumption continues to rise 2% per year, by 2050 the industry will need 298 million bags of coffee—double current world production.

Production as usual

Even if the next three decades follow the trends of the past three decades, coffee production will not be able to keep pace with rising demand. The minimum gap that coffee agricultural R&D will need to address through improved varieties and agricultural practices will be 60 million bags.

Climate change impact

And then there's climate change. Unless major efforts to adapt coffee production for climate change are initiated, global production could be lower in 2050 than it is today.



COFFEE'S SCIENCE GAP

IMPACT OF CLIMATE CHANGE BY COUNTRY

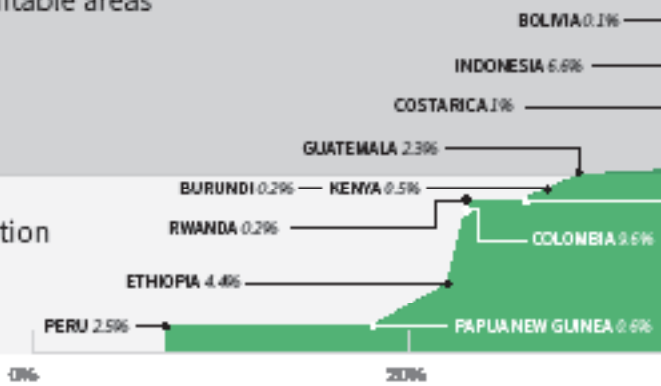
This is a unique moment for the coffee industry to accelerate R&D and climate change adaptation efforts to avoid severe impacts to global production.

Today nearly half (47%) of current coffee production comes from countries, including powerhouses like Brazil, India, and Nicaragua, predicted to lose more than 60% of their suitable coffee areas by 2050. The relative "winners" are the countries expected to see the least losses—but even these are predicted to lose up to 30% of suitable areas.

47% of current coffee production comes from countries predicted to **lose more than 60%** of their suitable coffee areas

32% of current global production **will lose 30-60%** of suitable areas

21% of current production **will lose <30%**

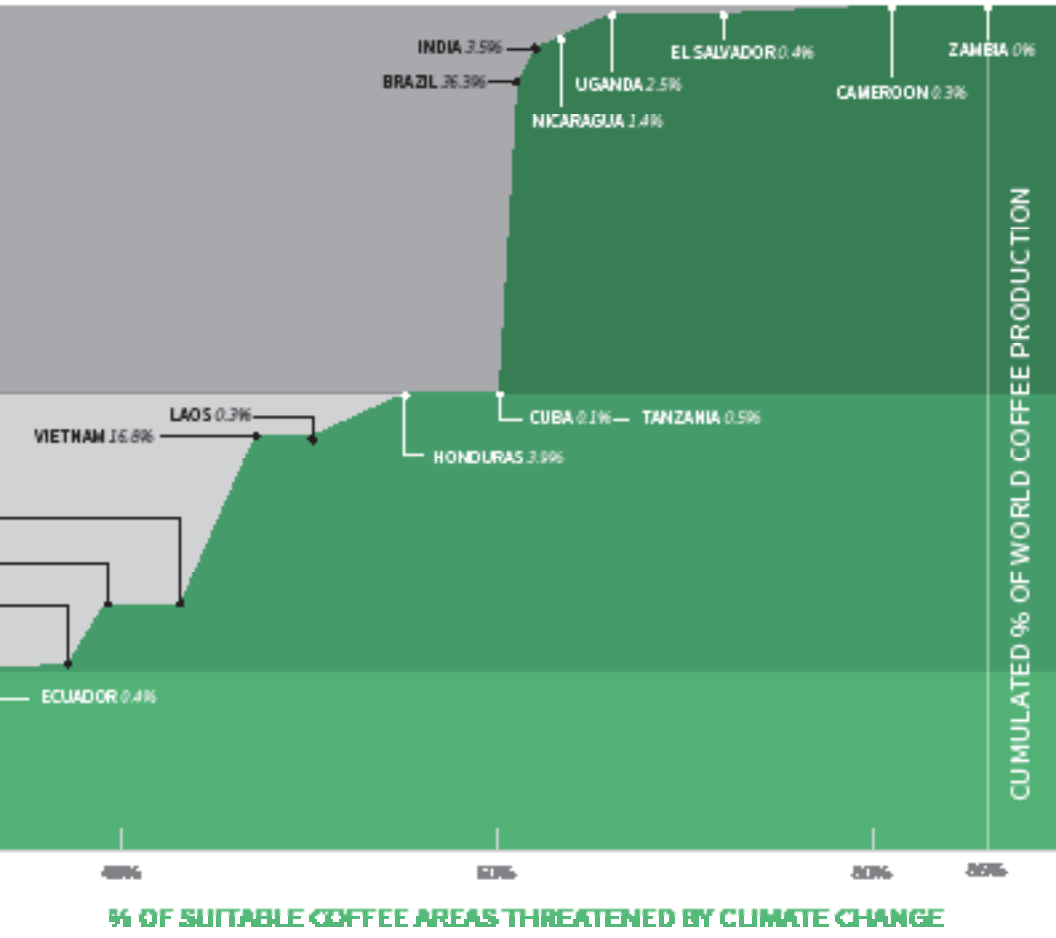


How to read this graph

The percentage next to each country's name shows its contribution to global production (ICO 2016). The country's location on the horizontal axis shows what percentage of currently suitable land will no longer be suitable by 2050. The vertical axis shows the cumulative climate change impact to global production.

Example: Brazil currently produces 36.3% of the world's coffee. It is predicted to lose approximately 60% of its suitable coffee land by 2050. Cameroon, which produces 0.3% of the world's coffee, will lost 80% of its currently suitable area.

Source: World Coffee Research. (2016). Identifying Long Term Variety Trial Locations, Provide Climate Information to Support World Coffee Research Variety Trials and Support on Trial Data Analysis. Unpublished raw data.



COFFEE'S SCIENCE GAP

WHY THE FUTURE OF COFFEE DEPENDS ON AGRICULTURAL R&D

A statement from the board of directors of World Coffee Research

Agricultural R&D—the continuous development of improved farm technologies and practices—has been a precondition for profitable farming for the last 150 years, and it works. The **average rate of return in investment is an astounding 43%**, according to the World Bank.

There is no shortage of scientific expertise to tackle the challenges facing coffee producers. The fundamental issue is funding and coordinating that research. Because of persistent lack of agricultural R&D funding, coffee has been one of the most under-researched and under-innovated crops in the world, despite its global economic value.

World Coffee Research came into existence to change that. Our organization enables the global coffee industry to invest in precompetitive, collaborative agricultural R&D to transform the coffee sector.

We believe it will be impossible for our industry to address its critical sustainability challenges without significantly increasing the collective investment in agricultural R&D. If we don't provide coffee producers with the tools, knowledge, and plants they need to succeed, our own businesses will founder.

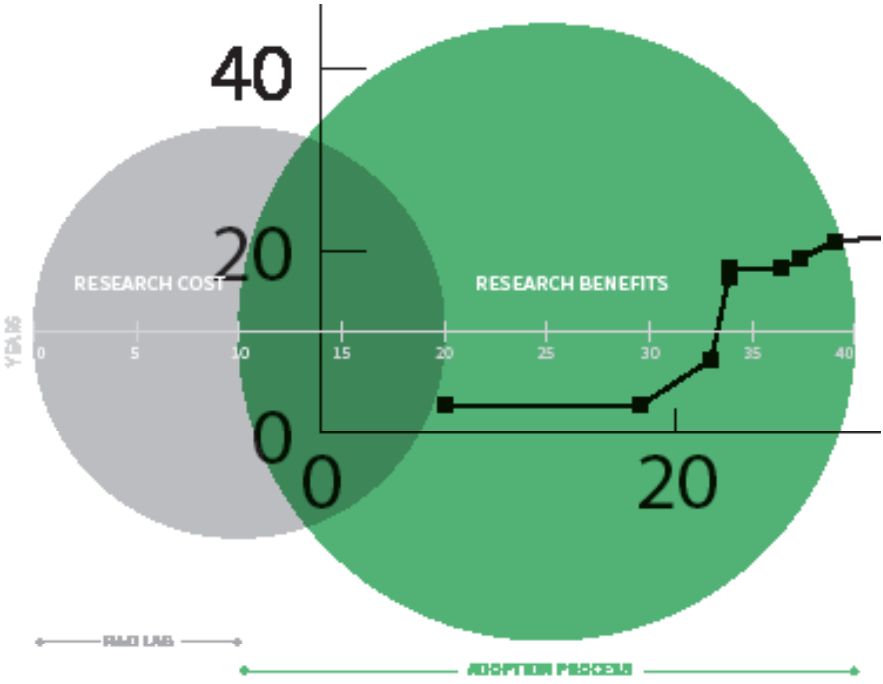
The global coffee industry has an unprecedented opportunity to make strategic investments in agricultural research. But investment must begin now. Research takes time. (The typical return of benefits on agricultural R&D is 30+ years.)

If we expect our businesses to be thriving in 2050, we need to work *now* to develop the next generation of improved coffee varieties.

Signed,
The World Coffee Research Board of Directors
(list of individual members on p. 60)

The World Coffee Research Board of Directors at Flor Amarilla research farm in Santa Ana, El Salvador in June 2017. Credit: World Coffee Research

The typical return of benefits on agricultural R&D takes 30+ years.



CLOSING THE GAP: OUR FIRST FIVE YEARS

BETWEEN 2012 AND 2017, WE LAID THE FOUNDATION FOR A GLOBAL RENAISSANCE IN COFFEE AGRICULTURAL R&D

In 2017, World Coffee Research celebrated the close of its first five years of research activity. In this time, we have proudly built an exceptionally strong foundation for global coffee R&D. In just five years, we have established 60 new coffee candidate varieties in development, two global breeding hubs, and an unprecedented international network of research trials to test variety performance, agricultural approaches for climate resilience, and profitability for coffee farmers.

Some highlights include:

New candidate varieties for climate change, quality, production, disease resistance:

- 60 F1 crosses made and in evaluation (created using new World Coffee Research core breeding population)
- 2 breeding hubs established: Central America, East Africa
- Created a plan for the global conservation of wild coffee species for future breeding
- Created the *World Coffee Research Sensory Lexicon*, a new tool to enable breeders to improve cup quality

Knowledge to transform Good Agricultural Practices to Best Agricultural Practices and raise farmer profitability

- Launched a global network of on-farm trials to study variety/agronomy interaction and profitability (22 of 1134 planned trials are in the ground)
- A technical manual for agronomists for holistic management of coffee rust

Enable sector-wide renovation with the best-performing coffee varieties

- Expand open-access information about the world's best available varieties through the publication of the *Arabica Coffee Varieties* catalog
- Enable the emergence of a transformational new market segment—trusted, professionalized nurseries and seed producers—through the launch of a new global standard: World Coffee Research Verified℠
- Expand access to international best varieties through the International Multilocation Variety Trial established in partnership with coffee institutions in 24 countries

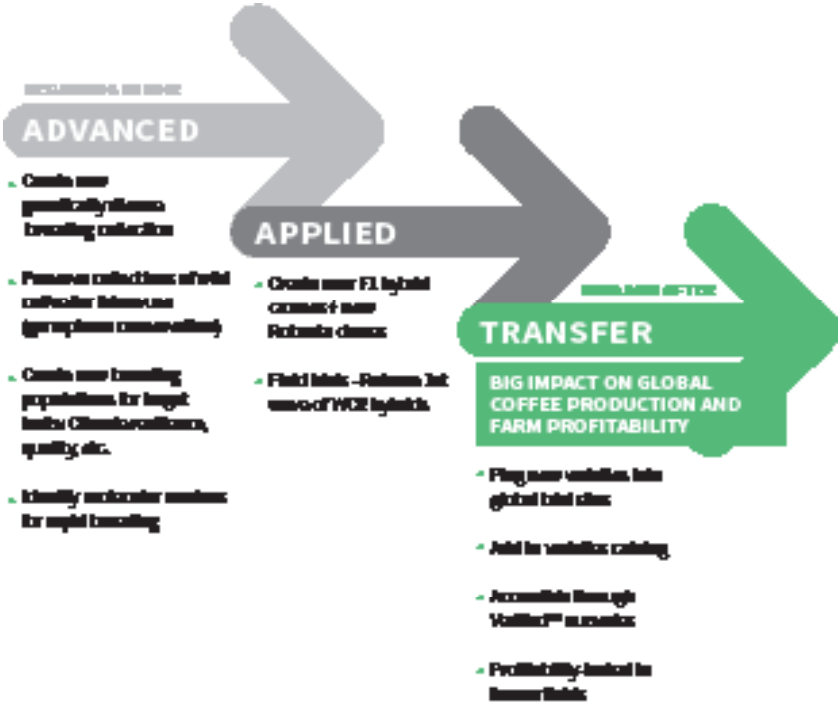
Preparing healthy plants at a World Coffee Research Verified℠ nursery. Credit: Bram de Hoog

To read a full report of our first five years, visit:
worldcoffeeresearch.org/first_five_years

GLOBAL BREEDING PROGRAM

Creating the future of coffee

Coffee has never had a global effort to coordinate breeding. By drawing on the latest breakthroughs in coffee genetics, and working in collaboration with and providing support to individual country breeding programs, we are fostering the next generation of coffee varieties to meet the challenges of the 21st century.



Enabling smarter, faster breeding

You need a hammer to build a house, but someone has to make the hammers. We create the new knowledge and tools coffee scientists need in order to make genetic progress.

For example, World Coffee Research has created new collections of genetically diverse coffees for breeders to work with (called the World Coffee Research Core Collection) and we conduct gene discovery research to help make breeding more efficient. We have developed a global strategy for the protection of coffee biodiversity and we created the *World Coffee Research Sensory Lexicon*, a new approach for evaluating coffee's flavors and aromas that scientists and industry use to improve coffee quality. All of these efforts enable more efficient and cost-effective breeding.

A new target for climate-smart breeding—coping with 32°

A baby coffee plant put in the ground today will bear the full brunt of climate change over its 20 to 60-year lifespan. Prior research by World Coffee Research and our partners at the International Center for Tropical Agriculture (CIAT) predicted that current coffee lands will become significantly more unsuitable for coffee production by 2050 (see pp. 10-11 for more)—namely, hotter and drier. Recently, we began work to reach a more precise understanding of what *unsuitable* means, so that we may set targets for climate-smart breeding.

This new research shows clearly that rising temperatures pose the greatest threat to coffee, greater even than increased drought.

Arabica coffee's optimal average annual temperature range is 18–21°C. Our research shows that the average maximum temperature of the hottest month (MaxT) is the factor that will most drive current coffee areas to become unsuitable in the future. Unfortunately, by 2050, 79% of currently suitable coffee areas will face hottest-month maximums of 30°C. Over half of coffee land will see temperatures higher than that—54% will face hottest-month maximums of over 32°C (see table below and figure at right).

Coffee area facing extreme heat and drought

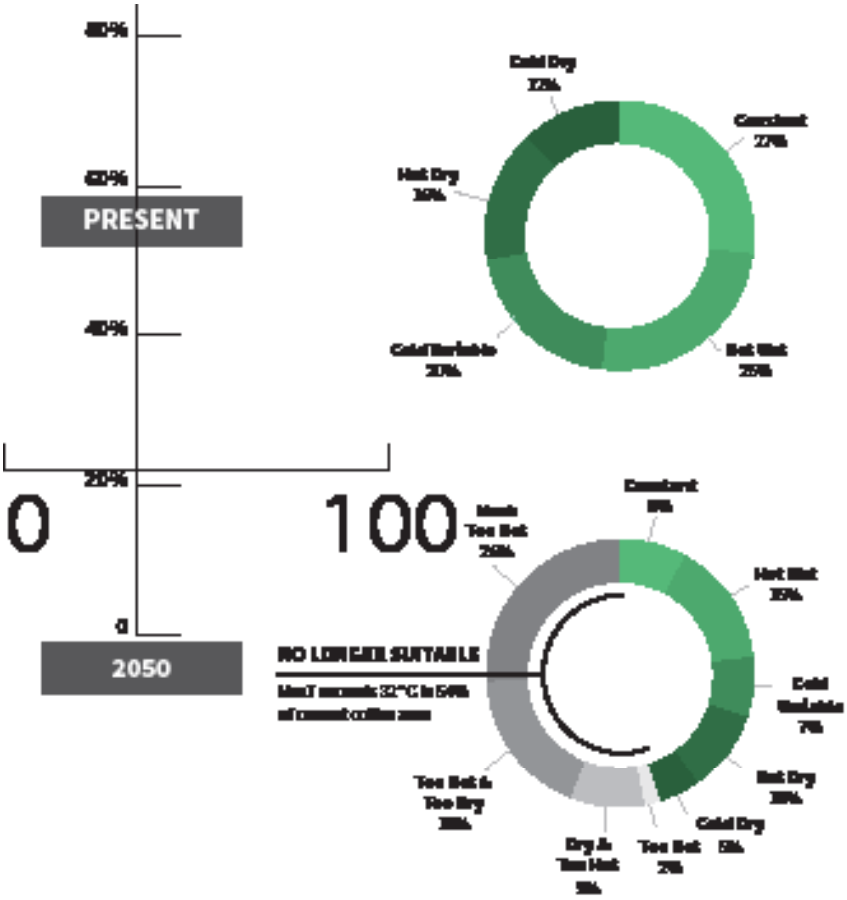
	Present	2050
Coffee area facing average maximum temperatures in the hottest month (MaxT) higher than **30°C**	25%	79%
Coffee area facing MaxT higher than **32°C**	0%	54%
Coffee area facing **5 months of drought**	0%	18%

Can we adapt the coffee plant for these hotter, drier future climates? In order to prevent the loss of this currently suitable coffee land, breeders will need to work to improve the heat tolerance of varieties, and the clear indication for breeders is that 32°C is the new target.

Additionally, more focus is needed on varieties tailored for agroforestry. Growing coffee under shade can create cooler micro-climates, which can lower the temperatures experienced by the coffee plant. Many farmers choose full-sun growing systems to maximize their how much coffee their farms produce. New varieties are needed that present

fewer trade-offs for farmers. World Coffee Research is partnering with a consortium of research institutions, called BREEDCAFS, on foundational research to understand how coffee genetics interact with agroforestry environments to enable this. Drought tolerance is also a major focus of the breeding initiative.

World Coffee Research plans to use this new knowledge in tailored breeding for climate resilience, and to strategize with breeders around the world to incorporate it into their work.



Percentage of suitable land today and in 2050. By 2050, more than half of currently suitable coffee land will be pushed into unsuitability. A key driver of that shift will be rising maximum temperatures, which will reach 32°C in over 54% of currently suitable lands.

Genetically diverse Core Collection

In 2015, World Coffee Research created a collection of genetically diverse wild-type *C. arabica* coffees that can be used by breeders to ensure long term and continuous genetic progress. The plants in the collection are also being studied to understand the link between phenotypic trait expression (the observable traits of the different plants) and different genotypes (their different genetics). Understanding these correlations allows breeders to pursue efficient molecular breeding that targets genetic markers associated with desirable traits.

Seeds from the Core Collection are germinated at our Flor Amarilla research farm. Each card represents one of the 97 accessions in the genetically diverse collection. Credit: World Coffee Research

EVALUATING THE CORE COLLECTION

97 accessions, **1,194** total plants at WCR research farm, **first year** of vegetative growth data collected

Up Next: Phenotype/genotype correlation

97 accessions, **8** used to create **66** experimental F1 hybrid families, **46** of which are currently in field evaluation in Central America

Up Next: Release 2-3 locally adapted varieties for Central American farmers by 2025; use Core Collection plants to create **locally tailored** F1 hybrid varieties for Africa

New F1 hybrid varieties in development

World Coffee Research is preparing a new generation of F1 hybrid varieties, aiming to release locally adapted selections for farmers in Central America and Africa starting in 2025. Varieties will be selected for different traits depending on the needs of local producers. In general, we expect F1 hybrid varieties to have significant yield increases (up to 20-40% over the current standards), high cup quality potential (some capable of scoring 90+ points), and overall vigor and tolerance to stressors like frost and diseases and pests, including coffee leaf rust.

A yearling F1 hybrid in the field at the World Coffee Research farm. This hybrid is displaying good vigor and will likely be selected for continued observation. Credit: World Coffee Research

So far, World Coffee Research has created three sets of F1 hybrid families:

46 traditional x wild Ethiopian F1 hybrid crosses 2015, **46** in field testing in 2016, **15** shipped to Rwanda hub for local selection, **13** sent to Zambia for evaluation in hot, dry climate expected to be the norm for coffee production zones by 2050

Up Next: Screen young trees for resilience to disease and heat/cold/drought stresses

15 Geisha or ET47 x traditional or introgressed F1 hybrid crosses in 2016

Up Next: Planting for field testing, screening, and local selection in Central America in 2018

5 "three-way" F1 hybrid crosses (F1 hybrid x Geisha or ET47) in 2017

Up Next: Planting for field testing, screening, and local selection in Nicaragua in 2018

The best candidates will be selected for eventual release to farmers, in partnership with national coffee institutes hosting trials of the varieties.

What does *F1 hybrid* mean?
F1 hybrid varieties are created by crossing genetically distinct parents (for example, a wild Ethiopian variety x Caturra). The offspring of the cross are first-generation (F1) hybrids. F1 hybrids are notable because they tend to have significantly higher production than non-hybrids, while maintaining high cup quality and disease resistance.

Faster genetic progress

Molecular breeding is an approach that allows breeders to be more efficient and targeted in their work. Molecular breeding is different from genetic modification. It allows breeders to make predictions about the traits a plant will have based on DNA profiles. For example, a breeder can screen a young coffee plant in a nursery for molecular markers associated with a trait like fruit shape, rather than having to wait to see the trait itself—which may

take years to show in a tree crop like coffee. This approach, called *marker-assisted selection*, can cut breeding time in half and substantially reduce the cost. This strategy is efficient when the desirable trait is governed by one or very few genes, such as dwarfism, pollen production, and some diseases.

For this approach to be used, researchers must first identify which genetic markers are associated with which desirable traits. In coffee, this work is just beginning. Our first goal is to identify relevant markers/genes. With our partners Nicafrance in Nicaragua and CIRAD in France, we are studying a population of trees to correlate variations in phenotype (observable traits, like plant height, yield, etc.) with the individual plants' genotypes via DNA testing.

384 coffee trees, **6,015** phenotype data, **32,400** leaf rust data, **6,770** productivity and coffee processing data, **3,886** bean analysis data, **384** DNA samples

Up Next: Create an integrated database

An agronomist takes vegetative growth measurements of plants in Nicaragua. Credit: Bram de Hoog

As key genetic marker targets are identified, World Coffee Research plans to use marker-assisted selection whenever it is relevant and efficient. As soon as the plants have leaves in the nursery, we will fingerprint them and see if favorable genes are present or not to dramatically reduce the time it takes to select plants for key traits and reduce the cost of creating new varieties.

A new Arabusta for the 21st century

On the island of East Timor, sometime in the 1920s, an impossible legend was born: the Timor Hybrid. Somehow, a *C. arabica* plant and a *C. canephora* (Robusta) plant reproduced and created a natural hybrid offspring—an Arabica variety that contained Robusta genetics. What made it legendary was the fact that this Arabica was resistant to coffee leaf rust, which no other naturally occurring Arabica is. Breeders spent much of the 20th century exploiting the Timor Hybrid to create new varieties resistant to coffee leaf rust—vast swaths of the world's coffeelands are now planted in the progeny of these efforts, often called Sarchimors (Timor Hybrid x Villa Sarchi) and Catimors (Timor Hybrid x Caturra).

But the resistance to leaf rust provided by the Timor Hybrid is showing signs of breaking down. It's time to try to create a new Arabusta—new Arabica varieties that contain Robusta genetics. World Coffee Research, together with partners from CIRAD and Nicafrance, is working to create new Arabustas that combine Robusta's rust resistance and adaptation to higher temperature with Arabica's high organoleptic quality. This is done by chemically inducing Robusta, a diploid that possesses two sets of chromosomes, to double its chromosomes so that it can successfully reproduce with Arabica, a tetraploid with four sets of chromosomes.

Male sterile *C. arabica* x tetraploid *C. canephora* T3751 cross created, **467** trees planted, **7,422** vegetative growth data points collected, **24,462** leaf rust data points collected

Up Next: Best individual back-crossed with Arabica, then 2-3 generations of selection = new Arabusta available for breeders

Marsellesa x tetraploid *C. canephora* T3751 cross created, seeds harvested

Up Next: Seeds germinated and transplanted to the field

PARTNER HIGHLIGHT: Rwanda Agricultural Board

A breeding hub for Africa

Breeding hub at the Rwandan Agricultural Board in Rubona. Credit: World Coffee Research

World Coffee Research is working in partnership with national coffee research institutes through a hub model. In 2018, we will formally launch our new African hub in Rwanda, hosted by our partners at the Rwanda Agriculture Board (RAB).

Through our partnership with RAB, we are collaborating to provide hub breeders with genetically diverse breeding material for the creation of local varieties. Improved varieties created in other regions will be shipped to Rubona for local adaption trials, and World Coffee Research will also support long-term breeding projects.

Between now and 2019, we also expect to establish a new hub in Asia.

EXPERIMENTAL HIGHLIGHT: Targeting improved cup quality

Quality is not objectively defined in coffee. Of course, defining quality descriptively isn't easy—there is disagreement in the industry about terms related to quality (for example, *gourmet*, *traditional*, and *specialty*). Moreover, different buyers of coffee will have different definitions of what quality means for them.

In order for breeders to truly incorporate quality into their agenda, as World Coffee Research aims to do, it is necessary to define objective targets for quality, we must somehow establish measurable criteria that breeders can use for selecting on the basis of quality. World Coffee Research is testing an innovative approach for classifying coffee quality according to market segments, then working backward to identify the attributes and molecules that underly the coffees characteristic of each segment.

Phase 1

Eight expert tasters representing different segments of the coffee industry used an approach called *signal noise detection* to rapidly classify 60 blind samples according to the simple question: Is this sample specialty? Tasters select one of five possible answers, ranging from "certainly not" to "absolutely." The strength of the signal allows us to see if the different samples cluster into clear quality groupings. Results: Despite the fact that the tasters represented different companies from different parts of the world with different conceptions of quality, the results point to a clear clustering of samples in three categories: "Commercial," "Specialty," and "High Specialty." Completed March 2017.

Phase 2

Send a representative set of coffees from each cluster identified in Phase I for detailed sensory descriptive analysis using the *World Coffee Research Sensory Lexicon* by a panel of expertly trained sensory analysts, and for chemical analysis of volatile aromatics through a modern technique called solid-phase micro-extraction (SPME). Completed December 2017.

Phase 3

Complete detailed statistical analysis to see if there are specific flavors and aromas and/or chemical volatiles that predict which cluster a given coffee will group with. If so, this will point us to measurable criteria that can be used to evaluate experimental new varieties to see if they are likely to meet desired or expected quality targets.

8 tasters, **60** coffees, **1,920** data points; **3** clusters identified, **12** samples sent for further sensory evaluation of **110** attributes and chemical evaluation of **100** volatile compounds

Up Next: Statistical analysis of chemical/sensory traits predictive of quality cluster to determine quality targets for breeding

Phase 1 of this experiment involved eight tasters rapidly assessing 60 coffees to answer the question: "Is this coffee specialty?" Credit: World Coffee Research

GETTING HEALTHY PLANTS TO FARMERS

Expanding access to the world's best varieties

The best varieties—the best genetics—in the world aren't worth a thing if they are not available to the farmers who need them.

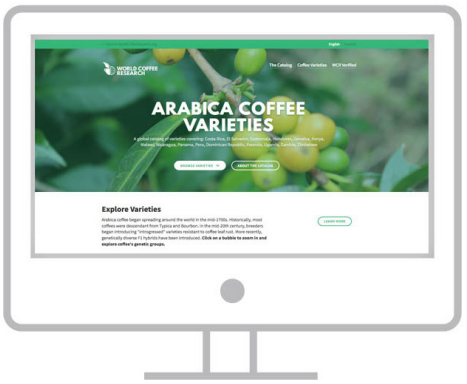
In fact, the vast majority of the world's farmers do not currently have access to improved varieties. This is why our work doesn't stop with breeding, but extends to programs that expand information about and access to high quality varieties around the world, though partnerships with both the public and private sectors.

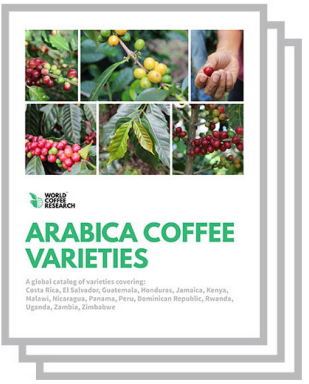
World Coffee Research's programs to increase the use of better varieties are designed around addressing key limiting factors to their widespread use.

Getting good varieties into the hands of farmers

Problem	Solutions
Farmers don't know about improved varieties and where/how to access them	A **catalog** that includes the major coffee varieties, tied to a database of **certified nurseries** that can provide healthy, genetically pure plants for each variety. *See page 30.*
Farmers aren't convinced about adopting new varieties, and/or can't get credit for renovating their farms	A **socioeconomic study** of the barriers to variety adoption among marginalized smallholders. *See page 32.* An international network of **on-farm profitability trials** (1200 in 20+ countries) that examines which combination of improved varieties and improved agronomic practices move the needle for the farmer on profitability, yield, and quality. *See page 34.*
Farmers in many countries don't have access to existing better varieties because those varieties are not commercially available in their country	An **international seed exchange** (the International Multilocation Variety Trial) of some of the top-performing varieties in the world, which allows countries to observe and test new-to-them varieties, and eventually select some of those varieties for commercialization in their country. *See page 46.*

Arabica Coffee Varieties Catalog





Coffee farmers should be able to make informed decisions about which variety will work best for their situation and needs. That's why World Coffee Research created our online, open-access varieties catalog. In 2017, the catalog was expanded to include four additional varieties cultivated in Central America—Mundo Novo, Pache, Starmaya, and T8867—and now integrates with our registry of World Coffee Research Verified[SM] nurseries so that users can readily locate trusted sources for new planting material.

In 2018, the catalog receives a major expansion, with the addition of 11 varieties cultivated in six African countries, as well as a new introduction.

Available online and free to download at
varieties.worldcoffeeresearch.org

World Coffee Research Verified℠

The nursery of La Cumplida in Nicaragua, which was audited as part of the pilot program for World Coffee Research Verified℠. Credit: Bram de Hoog

In 2017, we launched the World Coffee Research Verified℠ Program in Central America. World Coffee Research Verified℠ is the first global standard to certify that coffee seed producers and nurseries are producing healthy and genetically pure plants. The program recognizes that the coffee value chain starts with the seed, and that all coffee farmers deserve to have access to healthy plants.

As efforts to replant and renovate significant coffee areas ramp up in the next decade, the Verified℠ program aims to certify nurseries capable of producing billions of healthy, genetically pure trees for farmers worldwide.

In 2016-2017, plants from pilot nurseries were distributed to more than **10,000** farmers in Central America for the renovation of over **5,000** hectares using **20 million** trees.

To find or become a Verified℠ nursery visit:
varieties.worldcoffeeresearch.org/verified

Understanding farmer reluctance to adopt new varieties

A group of smallholder farmers from the Maya Kiche cooperative who planted the Centroamericano variety. At bottom right is Taya Brown, a Ph.D. student at Texas A&M University leading a study of smallholder perceptions of the new plants. Credit: World Coffee Research

Even if farmers have information about and access to improved varieties, they are not always interested in or able to plant them on their farms. Or, they may plant the variety but not find the same success with it as their neighbor. There can be many reasons for this: A lack of experience with the new variety and its particular needs and potential; a lack of trust of the person or institution promoting the variety; or the variety may not suit the farmers' needs.

Marginalized smallholders, such as those participating in a study of perceptions and acceptance of improved varieties in Yepocapa, Guatemala, may face even deeper barriers. In 2017, World Coffee Research and our partner Anacafe distributed seedlings of a new F1 hybrid variety called Centroamericano, to 179 farmers. Centroamericano is rust-resistant, high yielding in shade, and has high quality potential. The farmers participated in focus groups and field evaluations to understand their challenges and successes with the improved variety.

As an example of the extreme barriers to knowledge and information some of the

farmers in Yepocapa face, many study participants had inadvertently killed seedlings given to them in a prior project because they did not know to remove the plastic bags before transplanting the seedlings to the field; the project's technical assistants did not realize these smallholders had never encountered such bags before, which are standard in nurseries.

131,253 trees distributed to **179** farmers to renovate **43** hectares, **2** focus groups with **109** participants

Up Next: Follow-up individual interviews and data processing

Early feedback from the focus groups indicate that these marginalized smallholders—who lack any direct market access and have severely limited information to support their coffee production—faced numerous obstacles, including:

- Most of the participants don't own their land and are paying off debt, severely limiting their profitability and ability to improve production or quality.
- Most participants primarily sell their coffee cherry directly to middlemen (called *coyotes*) for the equivalent of ~$8/USD per 100lbs of cherry, which is well below market rate. The advantage is that *coyotes* will pick up cherry directly at the farm and pay in cash. Farmers who sell to their cooperative or another local mill receive a better price but have to make difficult and expensive transportation arrangements, and do not receive payment until two to six months after delivery of their cherry.
- Farmers are aware that cup quality is a goal, and they are interested in reaching high quality, but they have no ability to sell by quality or variety through any of their limited means of sale.
- Climate changes (varied rain patterns and warmer temperatures), weather shocks (hurricanes Stan in 2005, Mitch in 1998 and Agatha in 2010) and diseases (nematodes, coffee leaf rust, ojo de gallo and antracnosis) are prevalent, dramatically reducing coffee yield and quality/density and increasing insecurity for the farmers.

Aside from improved varieties, the farmers expressed a desire for better education and access to direct markets. They have pride in what they do and how hard they work and they long to be better represented and more respected in return for their efforts.

The final results of this study, combined with data on how the plants perform over time, will inform best practices for assisting smallholders to be successful with new F1 hybrid varieties.

Major funding for the study is provided by the Starbucks Foundation.

Which varieties put more money in farmers' hands?

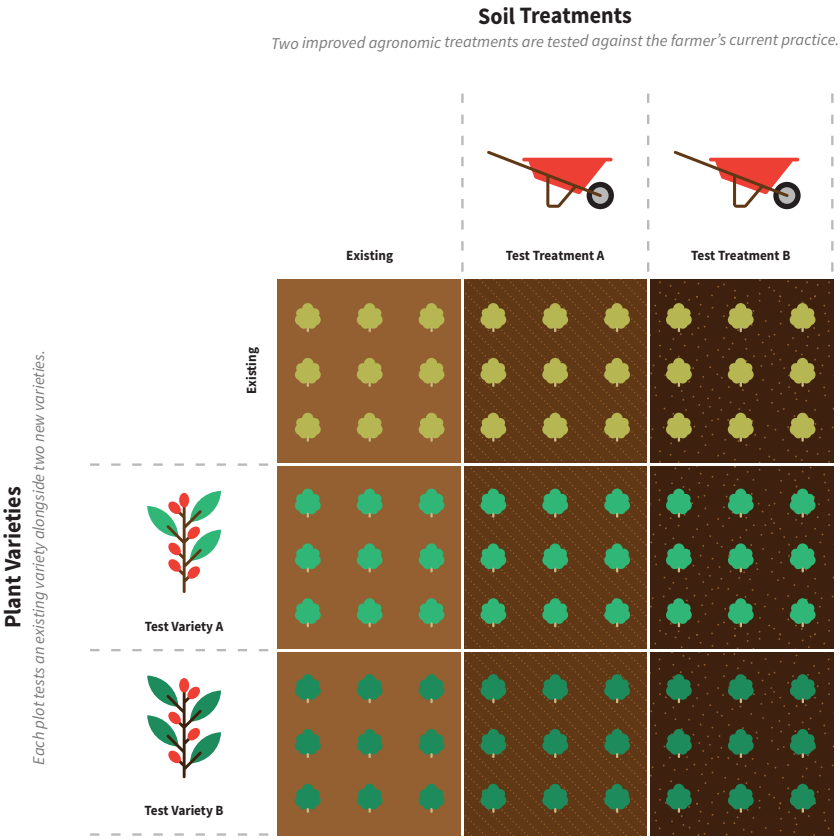
The Global Coffee Monitoring Program

Juan Hurtado's farm is hosting a trial to study how improved varieties and agronomic practices improve profitability, part of the Global Coffee Monitoring Program. Credit: Catholic Relief Services

Juan Hurtado is talkative and convivial and has a lot to say about what it means to be a coffee farmer and caretaker of the land. Last year, Juan won a national prize for being an outstanding steward of water resources on his farm in the Jinotega coffee region of Nicaragua, where he operates his own small mill. Despite being energetic and resourceful, Juan still faces a question that for many producers is existential: How to become more profitable?

Together with partners Catholic Relief Services (CRS), ECOM, and Keurig Green Mountain, we are working with Juan to answer this question. Juan's farm is part of our Global Coffee Monitoring Program, a global network of on-farm trials that will grow to 1,100 sites in 20 countries globally by 2022 (see more on page 50).

Top and bottom: A Global Coffee Monitoring Program trial site. Credit: Bram de Hoog.



Each on-farm trial has nine *treatment areas* which contain different combinations of variety and agronomic approaches.

In 2017, technicians from CRS assisted Juan to install the trial, a grid of nine treatment areas combining Juan's existing main variety plus two improved coffee varieties, and his existing farm management approach with two improved agronomic approaches tailored for his farm. Over the next five years, we will monitor which combination of variety and agronomic approach returns the highest yields, the highest quality, and most importantly for Juan, the highest profitability. The trial gives him hard data he can use to plan further improvements to his farm, secure loans from local lenders, and to share with neighboring farmers.

This sort of evidence-based information about farmers' best options for new plantings and agronomic innovations is unprecedented in coffee, and is different from typical demonstration plots (which do not have scientific trial design or produce statistical analysis results). It will assist Juan to remain a profitable, passionate coffee producer and a steward of an essential watershed.

PARTNERS HIGHLIGHT: Catholic Relief Services (CRS), Keurig Green Mountain, and ECOM

Impact that ripples out through the supply chain

Juan's trial, like the others in the program, is structured to involve as many supply chain partners as possible. CRS is providing technical assistance and monitoring on the trial; Juan's coffee is sold to the exporter ECOM and then, together with other coffees in the CRS Blue Harvest program, purchased by Keurig Green Mountain. Each partner makes financial or technical contributions to make the trial possible. Meanwhile, the knowledge generated from Juan's trial will be taken up by these partners and applied throughout their networks and supply chains, contributing to a ripple effect of farm improvement around the world. *For more on this partnership model, see page 51.*

A Marsellesa plant on a Global Coffee Monitoring trial site in Nicaragua. Credit: Bram de Hoog

COFFEE LEAF RUST IN CENTRAL AMERICA

In 2017, World Coffee Research wrapped up contributions to a four-year research program addressing the devastating effects of coffee leaf rust in Central America. The program was led by Texas A&M University, with major funding from USAID and World Coffee Research member companies, with partners including PROMECAFE, CATIE, CIRAD, Starbucks, and many others.

The program built an essential foundation for ongoing and future efforts to ameliorate the effects of coffee leaf rust in Central America.

Major outputs of the program over the last five years include:

- Creation and distribution of *Coffee Varieties of Mesoamerica and the Caribbean* catalog
- Creation and launch of the World Coffee Research Verified℠ nursery certification
- Establishment of International Multi-Location Variety Trial sites across Central America
- Creation of a new hub for Central American coffee breeding, which has already produced 66 rust-resistant or rust-tolerant F1 hybrid crosses
- Publication and distribution of a Spanish-language manual of best agronomic practices to control rust
- New research on the interaction between shade and rust
- New research on biological controls for coffee leaf rust

The role of shade and nutrition in controlling rust

Some types of shade may actually make coffee leaf rust worse, despite being an important practice for coffee growers amid rising global temperatures. Credit: Bram deHoog

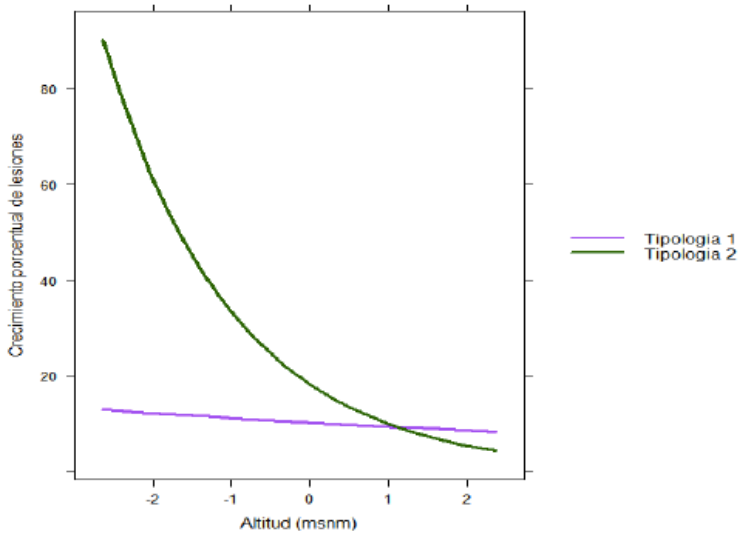
Many existing approaches for controlling coffee leaf rust are one-sided: Use rust-resistant varieties, or spray with as much fungicide as you can afford. But it is increasingly evident that we need to open new fronts in the fight against coffee leaf rust. To do so, we need better science on how rust interacts with coffee microclimates, different management practices, and with the coffee plant itself. Two studies from the expert Jacques Avelino are adding essential understanding of how coffee leaf rust interacts with coffee, pointing to insights into how it can be controlled.

Shade and coffee leaf rust. In general, there is more coffee leaf rust under shade than on plants grown in full sun. However, shade-grown coffee is typically better able to defend itself against a rust infection because shaded trees are not as stressed as full-sun trees. And clearly shade is necessary to cope with climate change—abandoning shade entirely is not a viable approach to managing coffee leaf rust.

Avelino conducted a study for World Coffee Research at CATIE in Turrialba, Costa Rica, to determine whether there are approaches to reduce the negative effects of shade, without diminishing the positive effects. The team concluded that shade tree species that increase the so-called “washout” of coffee leaf rust spores (e.g., the gentle washing of spores off leaves to the ground, without spreading the spores), would help to reduce the intensity of coffee leaf rust infections. This points to an intriguing conclusion: That some

types of shade tree may be better than others for controlling coffee leaf rust outbreaks. Small shade trees with small, flexible, lobbed leaves or easily manageable shade trees that enable high shade cover in the dry season and low shade cover during the rainy season are of interest for that purpose.

Nutrition and coffee leaf rust. A second study looked at the interaction between altitude and two main approaches to crop management—fertilization and spraying fungicides—on the severity and growth of coffee leaf rust infections.



Average growth of individual rust lesions with high levels of fertilizers (T1) vs. high levels of fungicides (T2). The results show that at lower altitudes, where rust thrives, high levels of fungicide application are not very effective at controlling rust. The effectiveness of fungicide raises as altitude increases. However, plant nutrition contributes to low levels of infection regardless of altitude.

Avelino's team examined in detail a representative set of 48 plots in Acatenango, Guatemala, gathering data on more than 30 variables including soil and leaf analysis, shade type, management type, and altitude. The team measured not only the percentage of leaves infected with rust, but also the growth of individual lesions on individual leaves.

The result? Clear, rigorous data from working farms showing that fertilization enhances the plant's physiological response in fighting the growth of rust lesions—and that **at low latitudes where rust thrives, applying fertilizer was more effective at controlling rust than spraying with fungicide**.

Common sense would tell you that a healthy, well-fed plant is better able to fight off infections. However, no hard facts or rigorous studies have previously proven this assumption. This is a significant contribution to a growing body of research that demonstrates that attending to plant health in general will be essential for managing coffee leaf rust in the future. It is especially important given the well-founded concern that coffee leaf rust may overcome the resistance mechanism in many existing rust-resistant varieties, as has happened with the Lempira variety in Honduras.

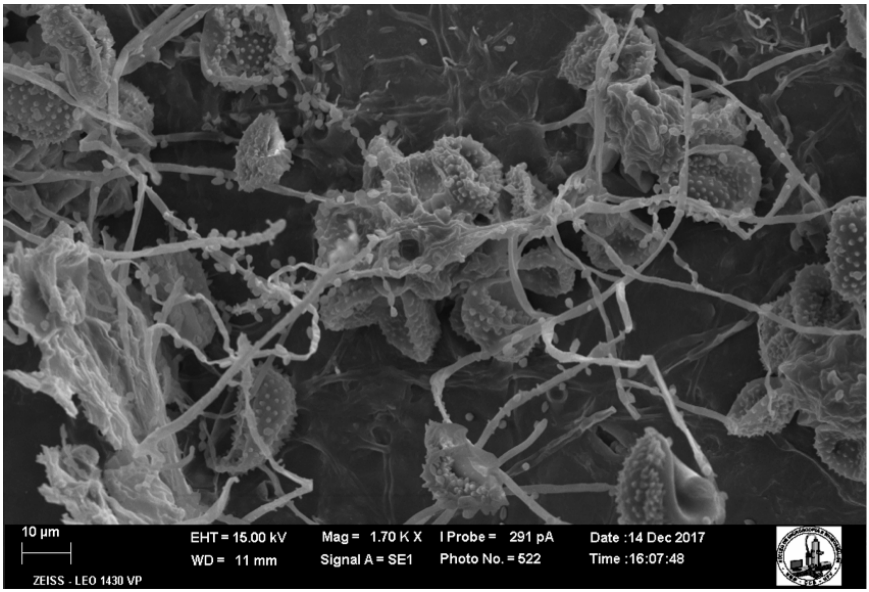
Biological control of coffee leaf rust

Costly fungicides and pesticides aren't the only way to control pests and diseases on a farm. Left alone, nature has developed complex and effective ways of reducing damage by diseases. Such natural control exists because every organism in nature has a range of natural enemies—competitors, parasites or predators—that are capable of reducing the size of its population. In the wild, coffee leaf rust has its own range of natural enemies. When coffee and coffee leaf rust were removed from their place of evolutionary origin in Africa and began to be cultivated in new environments, rust was able to thrive and become more aggressive because it had left behind its natural enemies. *Classical biological control* reunites pests with their natural enemies.

Two types of fungi are known to be particularly important for coffee leaf rust. Fungi that "eat" other fungi such as coffee leaf rust are called *mycoparasitic fungi*. Other organisms, capable of living inside the tissue of the coffee plant and working as bodyguards, protecting the plant against attacks by diseases and pests like rust, are called *endophytic organisms*. Both types of beneficial organisms might be exploited on coffee farms as organic control products or sustainable tools for managing coffee leaf rust. World Coffee Research is working with researchers Robert Barreto and Harry Evans at Universidade Federal de Viçosa in Brazil to identify and evaluate such organisms to be used in the fight against coffee leaf rust.

1216 potential rust enemies collected in Brazil and Africa, **333** selected and screened for effectiveness to reduce rust in the lab, **12** microorganisms (4 endophytes and 8 mycoparasites) showed promise in inhibiting rust

Up Next:
Detailed evaluation



A pustule of *H. vastatrix* (coffee leaf rust) parasitized by unknown Sporothrix-like fungus (possibly new genus). Credit: Robert Baretto

In 2018, the research will continue with detailed evaluation of the physiological effect of promising mycoparasitic fungi on coffee leaf rust infection, disease development and plant health, as well as testing the beneficial impact of endophytic organisms in promoting healthy coffee plants and drought resistance.

BIG DATA AND BIG COLLABORATION

Our international network of trials

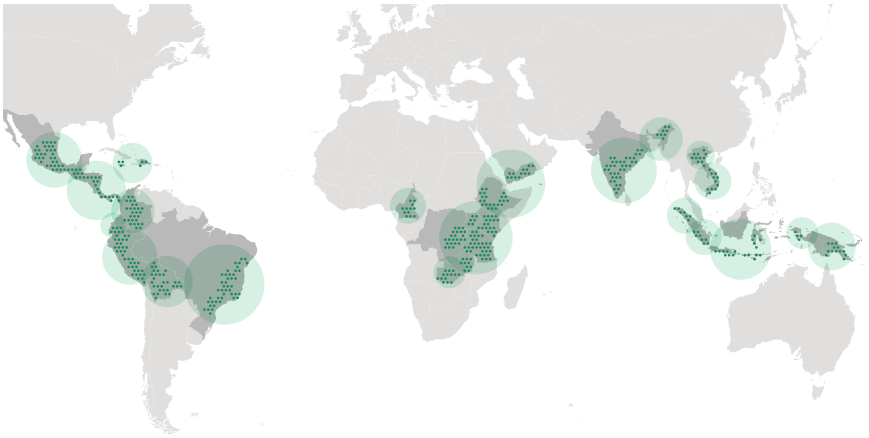
In our first five years, World Coffee Research has built an unprecedented international network of research trials.

Our network is testing variety performance and agricultural approaches for climate resilience, tracking coffee disease/pest movement, and—perhaps most important of all—building collaborative research capacity with our partners in coffee producing countries. The latter includes funding and training for partnering research institutes to carry out global trials, mentorships in coffee breeding, joint publication, and long-term training opportunities.

Highlights include:

- Two major trial networks: International Multilocation Variety Trial (tests varieties in research station settings), and Global Coffee Monitoring Program (tests varieties and agronomic treatments in farmer fields)
- Collaborative field trials in place in 21 countries, backed by partnership agreements supporting collaborative research conducted together with origin country research institutes, national coffee programs, universities, and the private sector.

Each dot represents a current or planned trial site



International Multilocation Variety Trial

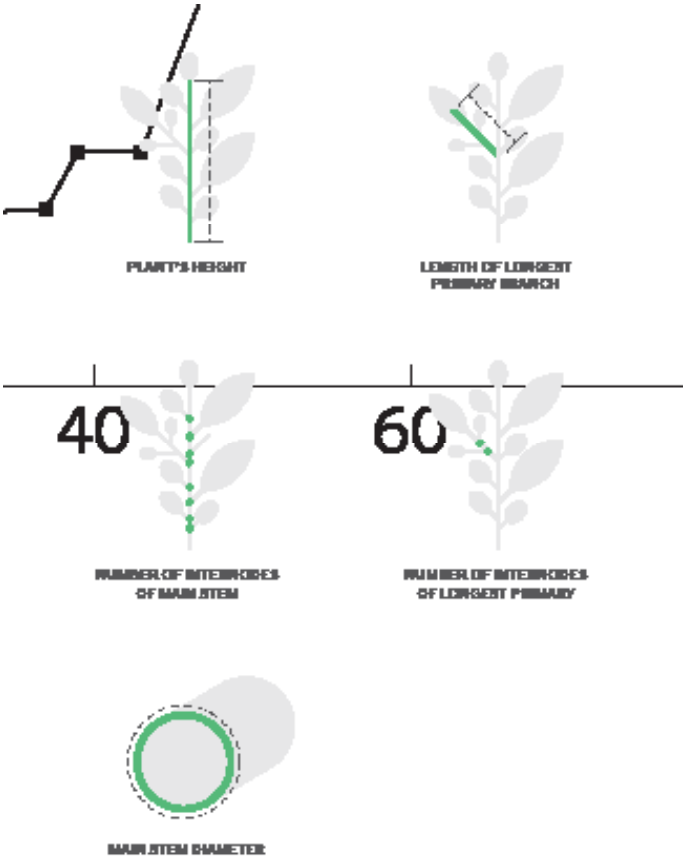
Field trials are now in place in 14 participating countries and the first vegetative growth data was collected in 2017. Credit: Bram de Hoog

Our first major program beginning in 2012 was to establish the world's largest coffee variety performance trial and seed exchange—the International Multilocation Variety Trial, or IMLVT. The trial brings 31 of the world's best Arabica varieties to 23 countries for rigorous testing and evaluation. Each participating country executes the trial collaboratively with World Coffee Research, assigning researchers to install, monitor and maintain the research plots. No program has ever previously achieved this level of coordination among coffee producing countries.

Countries observe the varieties and if they determine that one (or many) are well-adapted to local conditions and perform better than their current standard, World Coffee Research assists them in arranging to bring the new variety into the country for commercial production. By dramatically altering the available options for farmers in many countries, it has the potential to significantly increase global coffee production. The platform will also allow us to rigorously study how different varieties perform in different environments, what researchers call the *genetic x environment* (GxE) interaction, the results of which will enable smarter breeding in the future.

Why the trial matters. In February 2017, the trial returned its first major result: the discovery that a number of newer F1 hybrid varieties are tolerant to frost. The varieties were created in Central America, which typically does not experience frost, so this tolerance was previously unknown. This could be very important for coffee producing regions that experience more frequent frosts, such as Brazil, Peru, Zambia, and Zimbabwe.

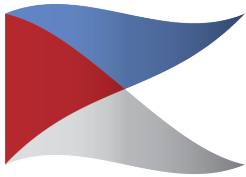
In 2017, the trial reached its most important milestone yet: analyzing the first data from the trial network! Of the participating countries, 14 had plants matured enough to collect the first vegetative growth and disease/pest data. Production and bean quality data will begin to be collected in 2018.



Measuring vegetative growth. In 2017, we gathered the first vegetative growth measurements of each individual plant's height, main stem diameter, length of longest primary branch, number of internodes of main stem, number of internodes of longest primary branch, leaf color and leaf shape.

IMLVT PARTNER HIGHLIGHT: Caravela Coffee

Committed to varieties



CARAVELA
COFFEE

Caravela Coffee, an import-export green coffee company, has long been respected for their deep commitment to close working relationships with coffee producers in Latin America to increase coffee quality and the long-term sustainability of farming. Over 50% of their team is dedicated to working full-time with the 4,500 producers they purchase coffee from. In 2017, Caravela Coffee deepened their commitment to the long-term future of coffee by increasing their financial contribution to the work of World Coffee Research in support of the IMLVT.

"As a company, we have been committed to the sustainability of coffee since our foundation. We are proud to be supporting World Coffee Research's innovative research by contributing USD $65,000 a year for the International Multilocation Variety Trial. We sincerely hope that all coffee companies, big or small, understand the importance of supporting World Coffee Research's efforts to ensure the long-term sustainability of coffee and of the millions of people around the world that depend on it for their livelihood." —Alejandro Cadena, CEO, Caravela Coffee

How an IMLVT trial works

Our partnership with INERA, Democratic Republic of Congo

Researchers take measurements at the INERA trial site in the Democratic Republic of Congo.

In November 2015, staff from the Institut National pour l'Etude et la Recherche Agronomique (INERA) received a box of dozens of vials, each containing an in vitro baby coffee plant. The plants—23 different varieties—were created using tissue culture cloning techniques in a lab in Florida to ensure they were completely disease-free. The INERA researchers carefully acclimatized the plants before transplanting them into soil in a greenhouse.

Plants were received in 2015, and planted in the field in 2016. Credit: INERA

A year later, in October 2016, the same staff donned gloves and took to the field with shovels. The plants were now mature enough to move to the ground and work began to install one of two trial sites in the Democratic Republic of Congo.

Six months after the plants were put into the field, INERA researchers have taken their first measurements of vegetative growth on 14 tall varieties and 18 dwarf ones. The plants are still too young to draw conclusions from these early measurements, but a major milestone has been crossed!

Global Coffee Monitoring Program

Which combination of varieties + agronomic practices deliver the highest yields, quality, + profits to farmers?

This trial is our most ambitious program to date. World Coffee Research is building the world's largest network of on-farm trials (1,100 sites by 2022)—called the Global Coffee Monitoring Program—to test how different combinations of varieties and climate-smart agricultural interventions affect yield, coffee quality, and—most importantly—profitability for farmers. The sites are selected to capture the diversity of coffee farm types, from large monoculture estates to smallholder-managed agroforestry farms, and are located in the full spectrum of coffee's different suitable agroecological zones.

In 2017, we made significant advancements in finalizing trial design protocols, hired a global program director, and secured partnerships to scale up the program from 22 to 150 trial sites between 2018 and 2022.

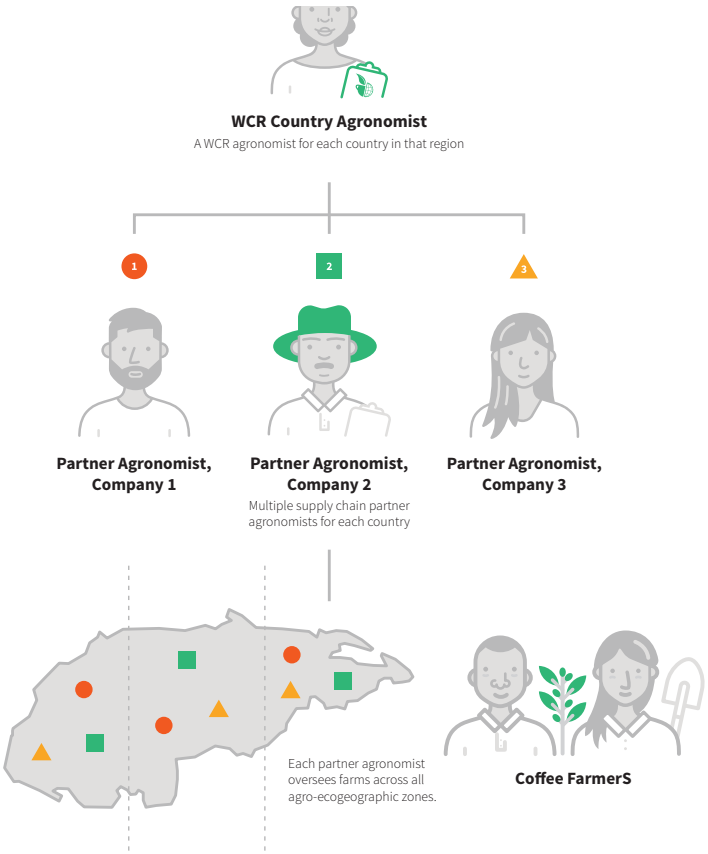
22 trials established in **4** countries; **150** trials will be installed in **11** countries in 2018

Up Next: 1,100 trials in 20+ countries by 2022. Over **500,000** healthy, high-performing coffee trees in the ground. Global data set on most profitable varieties + agronomic approaches.

Each on-farm technology trial will provide farmers with information to secure loans for making their farms more resilient. The data will be aggregated to provide a science-based global data set of varieties and agricultural practices for the first time, which will redefine farmer training protocols. Crucially, the trial also serves to familiarize farmers with improved varieties and farming approaches, acting as a key mechanism for disseminating new technologies and knowledge to producers worldwide.

Global Coffee Monitoring Program partnership model

Each trial is structured to involve as many supply chain partners as possible—this typically includes the farmer, an exporter or NGO that works directly with the farmer in his/her field providing technical support, and coffee roasters who both purchase the farmer's coffee and provide funding for the trial. The knowledge generated from the trials, which will be aggregated over regions and the globe, will be shared with our diverse collection of partners and applied throughout their networks and supply chains, contributing to a ripple effect of farm improvement around the world.



The program is structured to involve diverse partners in each country who assist farmers in their supply chains to install and maintain the trials under World Coffee Research's guidance.

Current Global Coffee Monitoring Program partners include:

- Costa Rica: ECOM Trading, Beneficiadora Santa Eduviges, Coopeterrazu
- El Salvador: ABECAFE
- Guatemala: Anacafe, FECCEG, Hanns R. Neumann Stiftung, USAID, EFICO Foundation
- Honduras: Capucas, EFICO Foundation, IHCAFE, Keurig Green Mountain, Hanns R. Neumann Stiftung,
  USAID, Volcafe
- Jamaica: Coffee Industry Board
- Mexico: Exportadora de Café; California S.A. de C.V. (Neumann)
- Nicaragua: Catholic Relief Services, ECOM Trading, Mercon
- Panama: HiU Coffee, Rogers Family Coffee Company, MIDA
- Peru: Keurig Green Mountain, Volcafe
- Puerto Rico: Puerto Rico Coffee Roasters
- Rwanda: C. Dorman, ECOM Trading, International Women in Coffee Alliance, Rwanda Trading Company, Rwacof, Rwashoscco, Sucafina, Sustainable Harvest, Taylors of Harrogate
- Uganda: ECOM Trading, Great Lakes Coffee Company, IITA, Kawacom, Keurig Green Mountain, Hanns R. Neumann Stiftung, Sucafina SA, UGACOF, USAID
- Zambia: Northern Coffee Corporation
- Democratic Republic of Congo: Cooperative CCKA, Cooperative CPCK, Cooperative CEAK, Université Catholique de Bukavu, USAID

PARTNER WITH US

Bring smarter farming and improved livelihoods to your supply chain.

Contact us at info@worldcoffeeresearch.org to talk with us about becoming a partner in the Global Coffee Monitoring Program.

PARTNER HIGHLIGHT: Taylors of Harrogate

TAYLORS
of Harrogate · since 1886

Simon Hotchkin, head of sustainable development for Taylors of Harrogate (left) with managers of the Karengera washing station in Rwanda. Credit: Taylors of Harrogate

A lot of coffee companies talk about sustainability; some do it. Taylors of Harrogate is one of those companies, investing in community and environmental projects and working to build strong relationships with coffee producers. In recognition of their work to build a resilient and sustainable supply chain, in 2017 Taylors received a Queen's Award for Sustainable Development, the UK's most prestigious business award.

In 2017, Taylors strengthened their ongoing and long-term commitment to World Coffee Research, guaranteeing to invest 1 Euro cent for every pound of green coffee purchased toward coffee agricultural research and development through the World Coffee Research Checkoff Program. In 2018, Taylors will specifically assist World Coffee Research to bring the Global Coffee Monitoring program to farms in Rwanda.

"We need quality coffee as a business, but so do millions of people around the world who are dependent on coffee growing for their livelihoods. So research into how coffee can survive climate change, and how yields and quality of crops can be increased is vital for these farmers and smallholders." — Keith Writer, director of supply, Taylors of Harrogate

World Coffee Research farm

The World Coffee Research farm, Flor Amarilla. Credit: World Coffee Research

In additional to our global network of partner trial sites, World Coffee Research operates its own research farm in Santa Ana, El Salvador.

The farm, called Flor Amarilla, has four active trials and is home to the World Coffee Research Core Collection (a breeding population of 97 genetically diverse Arabicas) as well as a collection of 46 experimental F1 hybrids created using the Core Collection. Eighty of the 97 accessions in the Core Collection, which was planted in 2015, produced their first fruit this year. The hybrids are being observed for further selection and the first vegetative growth measurements were taken in 2017. In addition, the farm became home to an on-farm technology trial, part of the Global Coffee Monitoring program, which will evaluate varieties in combination with agronomic treatments to determine the most profitable results for farmers.

97 accessions (**1,194 trees**), vegetative growth, disease, and sensory data collected. **46** F1 hybrids (**527 trees**), first vegetative growth measurements taken in 2017. Global Coffee Monitoring Program trial site established.

Up Next: Expanded trials to include International Multilocation Variety Trial, rootstock grafting, and biochar.

YOU'RE INVITED!

@ Global Specialty Coffee Expo, Seattle

World Coffee Research Think + Drink
Friday, April 20, 2-4 pm

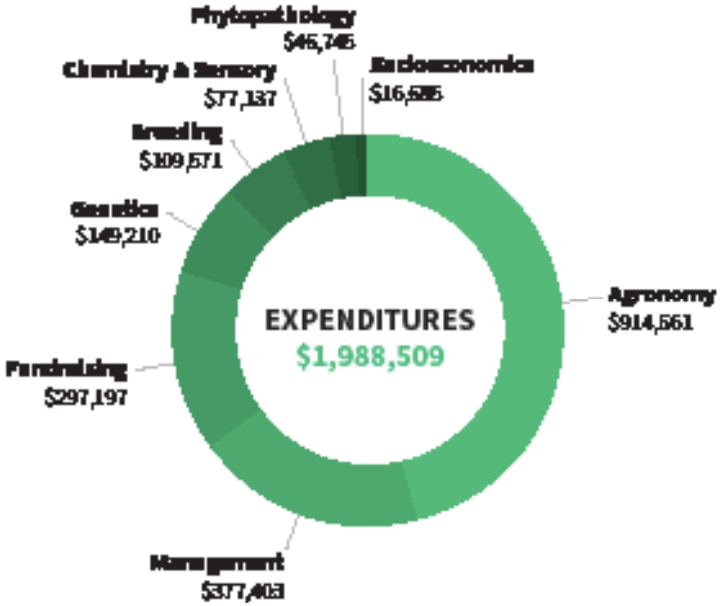
Join us to learn more about what we do and why we do it.

Preview a copy of the updated World Coffee Research *Arabica Coffee Varieties* catalog and taste unique African varieties during a special tasting offered by our friends at Counter Culture Coffee!

With a special tasting from

COUNTER CULTURE COFFEE

2017 FINANCES



2017 YEAR-END FINANCIAL POSITION

Cash: $1,103,022 **Other assets:** $ 889,671 **Liabilities:** $ 149,155

OUR TEAM

Our core scientific and administrative team apply their expertise in coffee, genetics, plant science, and diseases to create and execute an ambitious research agenda.

- Tim Schilling, *CEO*
- Christophe Montagnon, *Scientific Director*
- Greg Meenahan, *Partnership Development Director*
- Hanna Neuschwander, *Communications Director*
- Siaska Castro, *Administration and Finance Director*
- Danielle Knueppel, *Global Programs Director*
- Salvador Urrutia Loucel, *Central American Director*
- Francisco Anzueto, *Scientific Coordinator for Central America*
- Solene Pruvot-Woehl, *International Multi Location Variety Trial Coordinator*
- Sara Bogantes, *Global Coffee Monitoring Program Regional Coordinator, Central America*
- Pascal Gakwaya Kalisa, *Global Coffee Monitoring Program Regional Coordinator, East Africa*
- Sylvain Roulain, *R&D Agronomist, Congo*
- Benoit Bertrand, *Coffee Breeder*
- Julio Alvarado, *Flor Amarilla Farm Manager*
- Daniel Dubon, *Data Manager*
- Nicole Atwell, *Financial Accountant*

In 2017, our team grew to **16** people working in **7** countries.

COLLABORATING RESEARCHERS AND STUDENTS

Researchers and graduate students from around the world are working on problems and projects identified as essential by World Coffee Research core scientific staff.

- Jacques Avelino, *CIRAD*
- Bárbara Castanheira Ferrara Barbosa, *postdoctoral fellow, Department of Horticultural Sciences, Texas A&M University*
- Roberto Barreto, *Univerisdade Federal de Viçosa, Brazil*
- Fabián Echeverría Beirute, *Ph.D. student, Department of Soil and Crop Sciences, Texas A&M University*
- Espoir Bissimwa Basengere, *Universite Catholique de Bukavu*
- Jean-Christophe Breitler, *CIRAD-INECOL*
- Taya Brown, *Ph.D. student, Horticultural Sciences, Texas A&M University*
- Christian Bunn, *CIAT*
- Carlos Carvalho, *EMBRAPA*
- Harry Evans, *Univerisdade Federal de Viçosa*
- John Karuru, *Rwanda*
- Chris Kerth, *Agriculture & Life Sciences, Texas A&M University*
- Joseph Kimemia, *Kenya*
- Trish Klein, *Texas A&M University*
- Sarada Krishnan, *Denver Botanical Gardens*
- Leo Lombardini, *Texas A&M University*
- Christian Mas, *INERA*
- Simon Martin, *Rwanda Agriculture Board*
- Elias de Melo, *CATIE*
- Beatriz Moreno, *Anacaf*
- Elmer Roldan Salazar, *Ph.D. Student, Department of Horticultural Sciences, Texas A&M University*
- William Solano, *CATIE*
- Paul Songer, *Songer & Associates*

SCIENTIFIC ADVISORY COMMITTEE

These internationally renowned scientists are at the top of their fields, and volunteer their time to help guide and provide feedback on our research agenda.

- M. Catherine Aime, *Fungal Pathology Expert, Purdue University*
- Elisabeth Guichard, *Sensory Expert, French National Agronomic Research Institute (INRA)*
- Kyle Murphy, *Socioeconomics Expert, Jameel Poverty Action Lab (J-PAL)*
- Seth Murray, *Quantitative Genetics Expert, Texas A&M University*
- Walter Baethgen, *Climate Change Expert, Earth Institute, Columbia University*

In 2017, we established the external scientific advisory committee

BOARD OF DIRECTORS

Our board members are some of the most important leaders and thinkers from coffee companies around the world. They work hard behind the scenes to guide our programs.

- Tracy Ging, *S&D Coffee and Tea (Chair)*
- Mike Keown, *Farmer Brothers (Vice Chair)*
- Shawn Hamilton, *Java City (Treasurer)*
- Lindsey Bolger, *Keurig Green Mountain Coffee (outgoing)*
- Coleman Cuff, *Starbucks Coffee (incoming)*
- Frank Dennis, *Swiss Water Decaffeinated Coffee(incoming)*
- Furio Suggi Liverani, *illycaffè*
- James McLaughlin, *Intelligentsia Coffee and Tea*
- Monique Oxender, *Keurig Green Mountain (incoming)*
- Eric Ponçon, *ECOM Group*
- Ed Price, *Center on Conflict and Development, Texas A&M University*
- Ric Rhinehart, *Specialty Coffee Association*
- Matt Saurage, *Community Coffee Company*
- Marc Schonland, *Royal Cup*
- Brett Smith, *Counter Culture Coffee*
- Jim Trout, *The J. M. Smucker Company*
- Doug Welsh, *Peet's Coffee & Tea*
- Keith Writer, *Taylors of Harrogate*

OUR MEMBERS

MEMBERS

Our members—companies and organizations large and small—help set the global agenda for coffee research. Their support is the foundation for a vibrant and sustainable coffee sector.

103 companies and individuals supported our work in 2017, an increase of **45%** over the prior year.

Platinum

Farmer Brothers

KEURIG GREEN MOUNTAIN

USAID FROM THE AMERICAN PEOPLE

STARBUCKS®

SMUCKER'S THE J. M. SMUCKER COMPANY

S&D COFFEE & TEA

WILLARD E. SMUCKER FOUNDATION

Gold

- Community Coffee Company
- illlycaffè
- MARS Drinks
- Peet's Coffee & Tea
- Rogers Charitable Fund
- Taylors of Harrogate

Silver

- Allegro
- Caravela Coffee
- Counter Culture Coffee
- Foodbuy
- Gaviña & Sons, Inc.
- Java City
- Key Coffee Inc.
- La Marzocco International
- OLAM Specialty Coffee
- Probat Burns
- Royal Cup Coffee
- Tetra Tech ARD
- UCC Ueshima Coffee
- Union Hand Roasted Coffee
- UTZ

Bronze

- Arab Coffee Co.
- Batdorf & Bronson
- C-Coop
- Cafcom
- Camel Coffee Co.
- Coffee Review
- Dunn Brothers
- Equator Coffee & Teas
- Falcon Coffees
- Greenfolia
- Has Bean Coffee
- Honey Coffee Japan
- Intelligentsia Coffee
- Irving Farm Coffee Roasters
- Jack Parker
- Japan Roasters Network
- Kaldi's Coffee
- Kickapoo Coffee Roasters
- Kyokuto Fadie Co.
- Marubeni Food Corp
- Mr. Espresso
- Old City Coffee
- Orsir Coffee Co.
- Pacific Espresso
- Philz Coffee
- Prufrock Coffee
- Reunion Island
- Royal Coffee
- Salt Spring Coffee
- Sarutahiko Coffee
- Specialty Coffee Association of Japan (SCAJ)
- Sweet Marias
- Swiss Water Decaffeinated Coffee
- Tata Beverages/Eight O'Clock Coffee
- Terarosa (Hakasan)
- The Coffee Source
- TOA Coffee Co.
- Toby's Estate
- Tony's Coffee
- Walker Coffee Trading
- Wilbur Curtis

Supporters

- Amcafe USA
- Arbuckle Coffee Roasters
- Atlas Coffee Importers
- Brian Gaffney
- Bridge Coffee
- Buckman Coffee Factory
- Caravan Coffee
- Coffee by Tate
- Coffee Libre
- Coffee Nexus
- Crop to Cup Coffee
- Cuperus Koffie
- D. R. Wakefield
- Dark Woods Coffee
- Driftaway
- Forloren Espresso
- Francisco Javier Valle
- GAE Rock
- Genius Shan Highlands Coffee
- Greenway Coffee Company
- InterAmerican Coffee
- InterAmerican Coffee Europe
- Jake Robinson
- Jeremy Challender
- Jose Guillermo Alvarez
- Kazuki Hanyuda
- Los Cafetalones S.A.
- Mad Llama Company
- NEAT Coffee
- Nose Farm Garden
- Ozo Coffee
- Pacas Exportadora S.A. de CV Martínez
- Pedro Ros Casanova
- Pierre Charmetant
- RAVE Coffee
- Red Cedar Coffee Co.
- Roberto Llach
- Robin Nance
- Rose N Crantz
- Rose Park Roasters
- Ross Street Roasting
- Sean A. Barbanell
- Small Batch Roasters
- Southern Viking Trading Co.
- Spyhouse Coffee RoastingCo.
- Square Mile Coffee Roasters
- StrictAltura Coffees
- This Side Up Coffee
- Vessel Roasters
- Wahyuni Indriawam Bali
- Xtravert
- ZZP Ephemera Trading

DONOR HIGHLIGHT: Key Coffee Inc.

Building a legacy for the future

World Coffee Research CEO Tim Schilling visits an International Multilocation Variety Trial site in Sulawesi, Indonesia hosted by Key Coffee with Key president Mr. Yutaka Shibata. Credit: Key Coffee

Founded in 1920, Key Coffee Inc. is one of the most important and highly regarded coffee roasting companies in Japan. In keeping with their nearly 100-year legacy, Key Coffee Inc. is focused on the long-term success of the farmers with whom they work. Key is one of the only Japanese roasters involved in cultivating, harvesting, and processing Arabica coffee via the Toarco Toraja plantation, which they established in Sulawesi, Indonesia 40 years ago.

Key Coffee is not only a donor to World Coffee Research, but also an essential long-term research partner, a host to the International Multilocation Variety Trial, which will run for decades. Key Coffee Inc. hosts an IMLVT trial plot at their Toarco Toraja plantation, maintained in partnership with the Indonesian Coffee and Cocao Research Institute (ICCRI); it is one of three IMLVT sites in Indonesia and the only one on Sulawasi.

"By supporting and collaborating with World Coffee Research, we expect to contribute to ongoing development of the coffee production area around Toraja."— Masataka Nakano, Key Coffee

CHECKOFF PROGRAM PARTICIPANTS

Through the Checkoff Program, roasters and importers can directly support the future of coffee by contributing pennies per pound on every green coffee purchase. More information is available at worldcoffeeresearch.org/checkoff

Checkoff Participating Importers

- Atlantic Specialty Coffee
- Atlas Coffee Importers
- Bourbon Specialty Coffees
- Café Imports
- Cape Horn Coffees
- Caravela Coffee
- Crop to Cup Coffee
- D.R. Wakefield
- Engelhart Commodities Trading Partners
- Falcon Coffees
- InterAmerican Coffee
- InterAmerican Coffee Europe
- Hacienda La Minita
- N. J. Douek
- Nordic Approach
- OLAM Specialty Coffee
- Paragon Coffee Trading Company
- RGC
- Royal Coffee
- Schluter
- Sucafina SA
- Sustainable Harvest
- Swiss Water Decaffeinated Coffee
- The Coffee Source
- This Side Up
- Trabocca
- Volcafe Specialty
- Walker Coffee
- Zephyr Green Coffee

Supporting Roasters

- Allegro Coffee
- Caravan Coffee
- Camino Real Coffee Roasters
- Conifer Coffee
- Counter Culture Coffee
- Curve Roasters
- Darkwoods
- Driftaway Coffee
- Dunn Brothers
- Equator Coffee & Teas
- Fort Findlay Coffee
- Greenway Coffee
- Intelligentsia Coffee
- Irving Farm Coffee
- Java City
- Kaldi's Coffee
- Marigold Coffee
- Mr. Espresso
- NEAT Coffee
- North Fork Coffee Roasters
- Origin Coffee Limited
- Ozo Coffee
- Ozone
- Philz Coffee
- Quaffee
- Rave Coffee
- Rose N Crantz
- Rose Park Roasters
- Ross Street Roasting
- Small Batch Roasters
- Spyhouse Coffee Roasting
- Square Mile Coffee Roasters
- Tate Coffee
- Taylors of Harrogate
- The Beautiful Bean
- Tony's Coffee
- Vessel Roasters
- Workshop Coffee

OUR PARTNERS

This global network of coffee research institutions includes universities, consortia, public agencies, and laboratories including private company research departments. These institutions are models of the cooperative and collaborative approach necessary to face tomorrow's challenges.

- ABECAFE, El Salvador
- ACRN African Coffee Research Network
- AFCA Africa Fine Coffees Association
- ANACAFE Guatemalan National Coffee Association
- Beneficiadora Santa Eduviges, Costa Rica
- C. Dorman, Kenya
- CABI Centre for Agricultural Bioscience International
- CATIE Tropical Agricultural Research and Higher Education Center, Costa Rica
- CIAT International Center for Tropical Agriculture
- CCRI Central Coffee Research Institute, India
- CIC Coffee Industry Corporation, Papua New Guinea
- CIRAD French Agricultural Research Centre for International Development, France
- CRI Coffee Research Institute, Zimbabwe
- CRS Catholic Relief Services
- Crop Trust, Germany
- Department of Agricultural Research Services, Malawi
- EMBRAPA CAFÉ Brazilian Coffee Research Consortium
- ECOM Trading
- European Union Horizon 2020 Program
- Finca Aquiares, Costa Rica
- FNC Cenicafe, Colombia
- Fundaçion Aggie de El Salvador
- Global Coffee Review (WCR Media Partner)
- Great Lakes Coffee Company, Uganda
- Hanns R. Neumann Stiftung, Germany
- HARC Hawaii Agriculture Research Center
- ICCRI Indonesian Coffee and Cocoa Research Institute
- IITA Agricultural Research for Development in Africa
- Illycafe, Italy
- INECOL Institute of Ecology, Mexico
- INERA National Institute for Agricultural Research, Democratic Republic of Congo
- International Women in Coffee Alliance
- J. Hill & Cia, S.A. de C.V., El Salvador
- JACRA Jamaica Agricultural Commodities Regulatory Authority
- JNC Junta Nacional de Peru
- KALRO Kenya Agricultural and Livestock Research Organization
- KAWACOM, Uganda
- Keurig Green Mountain
- La Marzocco, Italy
- Mercon Coffee Group
- Ministry of Agriculture of Peru

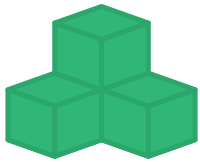
- NACORI National Coffee Research Institute, Uganda
- NAEB, National Agricultural Export Development Board, Rwanda
- NCCL Northern Coffee Corporation Ltd, Zambia
- Nicafrance, Nicaragua
- Norman Borlaug Institute for International Agriculture at Texas A&M University
- NSF International
- OLAM International Ltd.
- Peruvian National Coffee Board
- PROMECAFE – Regional Cooperative Program for the Technical Development and Modernization of Coffee Culture
- Puerto Rico Coffee Roasters
- RAB Rwanda Agricultural Board
- Royal Botanic Gardens, Kew, United Kingdom
- RTC Rwanda Trading Company
- Rwacof, Rwanda
- Rwashoscco, Rwanda
- San'a University, Yemen
- Starbucks and the Starbucks Foundation
- Southern Cross University, Australia
- Sucafina, Switzerland
- Tetratech
- Texas A&M Center for Coffee Research and Education
- UCB Catholic University of Bukavu, Democratic Republic of Congo
- UCC Ueshima Coffee, Japan
- UFV Universidade Federal de Viçosa, Brazil
- UGACOF, Uganda
- UTZ, The Netherlands

AFFILIATED ORGANIZATIONS

- ACE Alliance for Coffee Excellence
- CQI Coffee Quality Institute
- ICO International Coffee Organization
- NCA National Coffee Association
- SCA Specialty Coffee Association
- SCAJ Specialty Coffee Association of Japan

ENSURE THE FUTURE OF COFFEE

WE TURN YOUR PENNIES



INTO AMAZING RESEARCH

Through the Check-Off program, roasters can support our work by contributing pennies per pound or kilo of green coffee purchased through participating importers. See a list of participating importers and join the fight to save coffee at:

worldcoffeeresearch.org/checkoff

For information about direct investment, contact Greg Meenahan directly at **greg@worldcoffeeresearch.org**

WORLD COFFEE RESEARCH™