For more than 60 years, genetic improvement programs around the world have received genetic material from CATIE. The F1 hybrids, recently released in Central America, were derived from genotypes resistant to coffee rust that are available from our collection. The ICAFE (Costa Rica’s National Coffee Institute) program that generated the Costa Rica 95 variety (resistant to coffee rust) had more than 200 genotypes of Coffea arabica and C. canephora that were chosen from the CATIE collection (ICAFE 1998).

The Coffea canephora (coffee-rust resistant) genotypes, which form the basis of improved materials Ecuador still uses in the Amazon region, were introduced from CATIE between 1934 and 1986. In the 1960s, the introduction of the Geisha variety (also coffee-rust resistant) from CATIE’s collection to the ideal agroecological niche in the Boquete region of Panama resulted in excellent organoleptic characteristics that have been rewarded by record values in Internet auctions. The rootstock variety Nemaya (C. canephora) that originated from crossing two trees in the CATIE collection—T-3561 (2-C. arabica) and T-3751 (1-T.361)—is highly resistant to several species of nematodes in the genera Meloidogyne and Pratylenchus that are economically important pests in Central America.

2) F1 hybrids with impressively high potential. Under an agreement between CATIE, CIRAD and PROMECAFÉ, and with the participation of four Central American national coffee institutes, C. arabica F1 hybrids were developed that offer high production potential (a minimum of 30% more than commercial varieties currently used in the region), rustic vigor, adaptation to adverse climate conditions and good cup quality. Some of these F1 hybrids are resistant to coffee rust and have already been commercially released. CATIE has a somatic embryogenesis laboratory and long experience in the successful use of this technology for the reproduction of the above-mentioned F1 hybrids. The CATIE forest seed bank has also started to reproduce and offer these F1 hybrids using the more traditional technology of micro cuttings.

3) Solid track record of long-term alliances with the coffee sector. For more than 20 years, CATIE and ICIA have been members of the PROMECAFÉ network, formed by the coffee institutes of Central America, the Dominican Republic, Jamaica and Peru. CATIE works in close cooperation in projects and coordinated actions with numerous national and local agencies and organizations, such as the coffee cooperatives in Nicaragua, CAFENICA, COCOCAFÉ, PROCEOOP, SOPPEXCA and PROCOCE; in Honduras, particularly with IHCATEC and CORECAFÉ; in Guatemala, ANACAFE (a key partner); ADIPSCA, the Alборes Association and the Defenders of Nature; in Costa Rica, ICATE, Ministry of Agriculture/Institute for Agricultural Innovation and Technology Transfer (MAG-INTA), National Fund for Financing Reforestation (FONAFIFO), Consortium of Coffee Cooperatives (COCOCAFÉ) and the Coffee Forestry Foundation (FUNCAFOR).

4) Unique long-term trials of organic and conventional coffee agroforestry systems. Two significant long-term coffee system trials, designed to contribute to the scientific base that should guide decisions about what type of coffee production system to use, were set up by CATIE in different agroecological zones in 2000 and continue to be monitored: one is in Turrialba, Costa Rica, and the other in Masatepe, Nicaragua. These trials have been fundamental to the study of topics such as soil fertility, production, environmental services, diseases and pests, biodiversity conservation and the provision of ecosystem services. Each trial includes some 20 different coffee production systems; i.e., factor 1 (full sun or systems associated with different types of trees) combined with factor 2 (conventional or organic management with different levels of agrochemical or organic inputs). The behavior of different coffee varieties is also evaluated. For instance, in Costa Rica, the response of Cabrura, Costa Rica 95 and F1 hybrids (Central America and Millennium) are studied. As an example of their value, these trials have provided monthly data for a period of more than 10 years on the incidence of coffee rust in different production systems.

5) Adaptation, mitigation and reduction of vulnerability to climate change. CATIE has been involved in efforts from Mexico to South America to design and implement climate change studies to assist the coffee sector, particularly in the definition and execution of strategies for adaptation, mitigation and reduced vulnerability. In Mexico, CATIE was part of the inter-institutional group that developed the Strategy for Climate Change Adaptation, Mitigation and Reduced Vulnerability in the Sierra Madre of Chiapas and was charged with coordinating the process of drafting the strategy in collaboration with Conservation International (CI), the Commission for the Development and Promotion of Coffee in Chiapas (COMCAFE); COMA, UACH, CRUJO, ECOSUR, FIECH, PNUD and SEMAHN. In Costa Rica, Nicaragua and Honduras, CIAT, ICAFE, IHCAFE and UNA, to study Responses and Adaptation of Coffee to Climate Change in Central America (CAFADAP/IDB-FONATRO). The CASCADE project, led by Conservation International and CATIE, with support from the German Ministry of Environment and Energy, identified, tested, and transferred adaptation strategies for coffee and other farmers in Costa Rica, Honduras and Guatemala, using the ecosystem-based approach. In Costa Rica, CATIE actively participates in the development of the National Program for Payment for Environmental Services for shaded coffee plantations and in the establishment of Nationally Appropriate Mitigation Actions (NAMA).

CATIE has an impressive and long history of research and development in coffee and cacao. This includes genetic conservation and improvement, integrated management of diseases and pests, quantifying and valuing environmental services, analysis diversified production (with timber and fruit trees, for example) in agroforestry systems based on agroecological principles and promotion of value chains, adaptation and mitigation of climate change and reduced vulnerability.

This initial section, covering both coffee and cacao, highlights the institutional strengths that support research, development and education and the implementation of training and technical assistance projects with small coffee and cacao producers and their organizations. Following are Sections specific to each of these perennial crops that are the cornerstones of many sustainable rural economies and communities in tropical countries around the world.

1) Documentory database. CATIE has generated and collected a wealth of knowledge about integrated management of coffee and cacao plantations; for example, agroecological management of pests and diseases, such as coffee leaf rust and monilia pod rot of cacao. This extensive knowledge is accessible via the IICA/CATIE Orton Memorial Library.

2) Research program and graduate education. Coffee and cacao have been among the main research areas in CATIE master’s and doctoral programs for more than 40 years. The research group located in Turrialba, that works with agroforestry systems in coffee and cacao, consists of 15 researchers (11 PhD; 4 MSc) made up of CATIE staff and scientists from international organizations based at CATIE.
to farmers, with support from Hershey, ECOM and INIFAP. The genetic improvement program is now at work on another generation of clones, to be released in the near future. This is a good example of how CATIE’s research products reach farmers through collaboration with national actors and the world chocolate industry.

2) Agroforestry systems with cacao for adaptation, mitigation and reduction of vulnerability to climate change. CATIE has 35 years of experience in the design and management of cacao farms with different shade-tree species. Agriculture with trees is one of the best and most recommended strategies for climate-smart management of farms. Production of cacao in association with trees contributes to climate change mitigation (for example, carbon storage in wood and increased organic material on the soil) and adaptation (for example, diversification of production, reduction in air temperature of up to 5°C, reduced risk of fires, etc.). In addition, agroforestry systems with cacao help in the conservation of soil, water and biodiversity at local and landscape (territorial) scales. We are experts in the design and management of the shade canopy for cacao in order to improve the livelihoods of families and businesses and to provide other ecosystem services. We participate actively in the design and implementation of climate-smart policies in the cacao sector in Central America.

3) Design and management of development projects. CATIE has internationally recognized experience in the design and implementation of development projects with small-scale cacao farmers in Central America and several countries in South America and the Caribbean. We have worked with many mestizo (Mexico, Honduras and Nicaragua) and indigenous groups including Ngäbe and Naso in Panamá, Bribri and Cabécar in Costa Rica, Mayangna in Nicaragua, Maya in Belize and Guatemala, and Aymaras-Quechua-Mosetén in the Andes and Bolivian Amazon region. We have designed and implemented many “farmer field school” programs and strengthened producer organizations as well as their commercial entities. We have also supported the key actors and processes in cacao value chains at local, national, regional and international levels.

4) Important long-term alliances with the cacao sector. We have extensive social capital that empowers actions and broadens the impacts of the technological innovations that we introduce on farms in the region. For example, close ties with directors and decision makers in the cacao sector in the Central American countries, with those who control the cacao value chains in the region, with the donor community and with the national and global academic world. This includes an active research program with CIRAD, USDA, Bioversity International, ICRF and CABI; interactions with numerous national as well as international universities, such as Reading, Idaho and West Indies; work with the main Latin American cacao-research institutes, such as CELPLAC in Brazil, COPROICA in Colombia, INIAP in Ecuador, ICD in Peru and FIIHA in Honduras. CATIE collaborates closely with private sector organizations (World Cocoa Foundation, COPAL) and some of the largest chocolate companies in the world, such as MARS, Hershey, Nestlé, Mondelez and Felchlin. We are an influential actor in cacao forums such as INGENIC, INAFORESTA and INCOPED and we maintain strong ties to governmental entities, NGOs and groups of cacao producers throughout the hemisphere.

Cacao

CATIE has more than 70 years of experience in cacao research, education and development. That experience encompasses 10 major areas of work: 1) international cacao collection and global interchange of germplasm; 2) knowledge of the genetic diversity of pathogens and identification of disease-resistant cacao genotypes; 3) genetic improvement to produce high-yielding cacao varieties that are disease-tolerant and possess good industrial quality; 4) integrated pest management, especially targeting monilia or frosty pod (Moniliophthora roreri) and black pod (Phytophthora palmivora) diseases; 5) leading-edge molecular research with partners such as USDA, MARS, CIRAD, etc.; 6) agroforestry with cacao to improve productivity, minimize financial risk through diversification of production, and provide other ecosystem services; 7) design and management of cacao development projects directed to families of small producers; 8) formal education (technicians and students) and informal education (farmers and producer organizations); 9) production of teaching and extension materials as well as technical and international scientific publications on management topics, ecosystem services, climate change, technologies, concepts and methodologies; 10) permanent relationships with public and private institutions, chocolate companies, farmer organizations, development and international cooperation agencies, NGOs, etc., that are linked to the cacao sector.

1) Superior germplasm collection and cacao improvement program. CATIE has one of the two principal cacao germplasm collections in the world, initiated in 1944 and under public domain since 2004. The collection currently has almost 1,200 genotypes from around the world, particularly from the area where the species originated in the Amazon basin. These materials provide the basis for a permanent program to identify genotypes resistant to frosty pod or monilia (Moniliophthora roreri) and black pod (Phytophthora palmivora), materials that have been transferred to different countries and used as the cornerstone of local improvement programs.

In the past two decades, CATIE’s genetic improvement program has begun to have an impact on cocoa production in Central America and Mexico, with enormous potential for expansion to many other countries; for instance, all of the cacao-growing countries in the Andean region, where 600,000 hectares of cacao are cultivated. The genetic improvement program has focused on the search for alternatives against frosty pod, the most feared of the cacao diseases, which is already found in 13 countries in tropical America and which threatens to spread to other continents, putting world cacao production at great risk. The genetic materials produced in the program are also precocious (yield at a young age), tolerant to black pod and of high quality. For example, at the Salon du Chocolat in Paris in 2009, the jury selected chocolates made from CATIE-R6 and CATIE-R4 clones as among the best in the competition.

Six clones, recently released by CATIE, are already part of national cacao-promotion programs to improve productivity and, thereby, the living conditions of producer families. In Central America, more than 20,000 small-scale cacao-farming families and many producers’ associations now have access to these clones through a network of cacao gardens established between 2008 and 2012 by CATIE’s Central American Cacao Project (MAP-PCC; supported by Norway) and other public and private actors. In 2012 this collection of superior clones was introduced in Mexico for distribution

Coffee

1) Arabica coffee germplasm collection accessible to all. CATIE has one of the most important coffee germplasm collections in the world, containing 1,992 genotypes. The original collection was established in 1949 with materials introduced from Brazil, Guatemala and El Salvador. In 1960, the collection became much more valuable following the introduction of wild Coffee arabica genotypes from Ethiopia and Yemen collected by FAO, ORSTOM (now IRD) and IPGRI (now Bioversity International). This is the fourth-largest coffee collection in the world, containing a major part of the available genetic diversity of C. arabica. It is the most important collection of C. arabica on the American continent because of the number and diversity of genotypes protected: i.e., more than 800 wild genotypes of coffee plus diploid species; varieties, mutants and selections with resistance to coffee rust; interspecific and intraspecific hybrids; and research material. The agreements signed with FAO and the International Treaty on Plant Genetic Resources for Food and Agriculture define it as the most important "International Collection" of C. arabica under the public domain.