



Beltsville Agricultural Research Center



Building 001



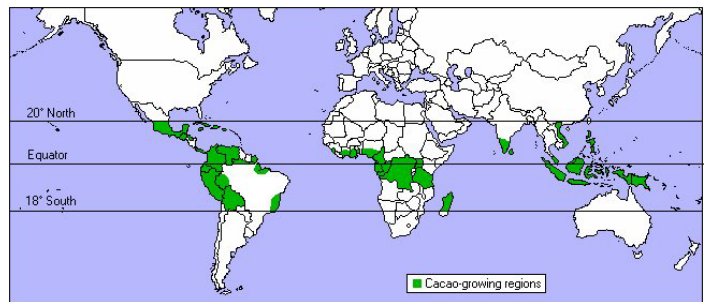
U.S. Department of Agriculture

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**Agricultural Research Service
 U.S. Dept. of Agriculture**

**Sustainable Perennial Crops
 Laboratory**



Cacao-growing regions

**Improving and Maintaining Perennial
 Crop Yields**

Research Mission

The mission of the Sustainable Perennial Crops Laboratory is to carry out research on perennial crops of significance to national and global economies with the goals of improving and/or maintaining crop yields with reduced inputs, preserving and optimizing use of crop genetic diversity, reducing the negative environmental impacts resulting from crop production, and providing consumers and manufacturers with safe and stable commodity supplies.

A. Biological and Chemical Disease Control and Development of Agronomic Systems for Cacao and Alternative Crops

Objective: Develop approaches to solving production problems of tropical crops with primary interests in production schemes for cacao and other alternative crops. This includes:

development of biocontrol of diseases, the study of ecology of interactions



among beneficials, pathogens, and plants, the optimization of biological and chemical pest control methods, the assessment of the soil infertility and management practices, and evaluation of responses of crops to stresses and management practices.

Approach: Classical and molecular techniques are being used to study ecology and genetics of interactions and evaluate genetic diversity among beneficial microorganisms to understand their role in the disease environment. The response of the pathogens, biocontrol agents and host plants to biotic and abiotic stress is being evaluated. Furthermore, methods are being developed to screen biocontrol agents, fungicides, and formulation additives for

the abilities to enhance disease control of tropical crops. In collaboration with other research organizations from tropical Latin American and Caribbean countries, field studies are being conducted to assess the impact of integrated pest management strategies, soil fertility, and crop management on the productivity and health of high value alternate crops in order to optimize production, tolerance to abiotic stresses, ecological adaptability, and disease control strategies to ensure sustainability.



B. Environmental Quality Impacts from Pesticide Use on Perennial Crops

Objective: To assess current pesticide use for selected perennial tropical crops by analyzing environmental fate, environmental contamination levels, and health-related effects. To describe and model pesticide transport and dissipation within the environment and the crop plants.

Approach: Pesticide residues are currently being monitored in tropical ecosystems.

Preliminary risk assessments are being applied to selected perennial crop/pesticide systems through application of simple first-tier modeling approaches aimed at surface and sub-surface water contamination potential. New small field-plot experiments have been established at several locations near Tarapoto, Peru for the purpose of determining the fate and behavior of pesticides used in the production of cacao, banana, and other cropping systems. One site constitutes a partially forested, partially cropped watershed, and stream water quality is being monitored. Laboratory studies and the development of analytical methods, leaching, persistence, and metabolism are being used to support the field research.

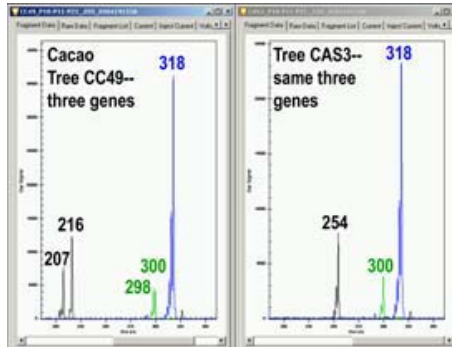


C. Molecular Characterization and Diversity Assessment of Cocoa Germplasm in the Americas

Objective: To characterize cocoa germplasm and reduce redundancy and misidentifications in international cocoa genebanks. Genetic diversity is also being assessed in Latin American cocoa gene pools to identify possible gaps for potential future collection or acquisition by specific genebanks. Additionally, the genetic identities of several major fungal pathogens of cocoa are being analyzed in an attempt to understand how genetic diversity functions in pathogenicity.

Approach: Through a collaborative consortium, cocoa samples are being collected from various cocoa producing countries in Latin America. The genotype of these samples are being determined with DNA fingerprinting technology, which includes both dominant and co-

dominant markers. Subsequently, by combining fingerprinting data with passport information it is possible to verify the genetic identities of cocoa accessions. Analytical tools of population genetics and bioinformatics are also assessing the level and pattern of cocoa genetic diversity within and among cocoa genebanks, in farmer's fields, and in natural populations. The resulting data is being used to improve the accuracy and efficiency in cocoa germplasm conservation and utilization. Likewise, DNA analysis of the different fungal pathogen populations is being used to understand population dynamics and to develop new breeding and control strategies.



SPCL is actively collaborating with government and non-governmental research initiatives, NGO's, universities and international research centers in Brazil, Peru, Cameroon, Costa Rica, Ecuador, Panama, Trinidad and the UK. Some of these organizations include:

US Institutes

Masterfoods/Mars, Inc:

WCF: World Cocoa Foundation, Vienna, VA.

Penn State: Pennsylvania State University

UF-IRREC: University of Florida, Indian River Research and Education Center, Ft. Pierce, FL.

UF-TREC: Tropical Research and Education Center, Homestead, FL

International Institutes

Almirante Cacao, Brazil

CABI: CAB International, United Kingdom

CATIE: Centro Agronomico Tropical de Investigacion y Ensenanza, Costa Rica

CEPLAC/CEPEC: Comissao Executiva do Plano da Lavoura Cacaueira/Centro de Pesquisas do Cacau, Brazil

CIRAD: Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement, France

CRU: Cocoa Research Unit, University of the West Indies, Trinidad and Tobago

EBCL: European Biological Control Lab, France

EMBRAPA/CNPAF: Empresa Brasileira de Pesquisa Agropecuaria/Centro Nacional de Pesquisa de Arroz e Feijao, Brazil

ICT: Instituto de Cultivos Tropicales, Peru

IESB: Instituto de Estudos Socia-Ambientals do Sul da Bahia, Brazil

IITA: International Institute of Tropical Agriculture, Nigeria

IPGRI: International Plant Genetic Resources Institute, Italy

IRAD: Institut de Recherche Agricole pour le Développement, Cameroon

Imperial College, UK

INIAP: Instituto Nacional Autonomo de Investigaciones Agropecuarias, Ecuador

STRI: Smithsonian Tropical Research Institute, Panama

UESC: Universidade Estadual de Santa Cruz, Brazil

UENF: Universidade Estadual de Norte Fluminense, Brazil

University of Reading, UK