

2023 ANNUAL REPORT FOR THE CODE OF CONDUCT

The CAOBISCO-ECA Joint Cocoa Research Fund

Background

The [Joint Cocoa Research Fund \(JRF\)](#) finances applied research projects aiming at the development of innovative solutions to current and upcoming key challenges of the cocoa sector. The transfer of the research results to the user group, e.g., the farmers, is a key element of all JRF projects. The Fund hereby helps increasing economic, social, and environmental sustainability of cocoa production. CAOBISCO administers the JRF jointly with the [European Cocoa Association \(ECA\)](#). It has currently 14 international member companies.

The research strategy of the JRF covers three areas:

- ✦ **Cocoa Bean Quality and Food Safety:** The research work is committed to the development of innovative tools allowing full conformity with regulations also in the future, with a focus on heavy metals, crop protection product and mineral oil residues, mycotoxins and acrylamide. Work on the International Standards for the Assessment of Cocoa Bean Quality is part of the strategy as well.
- ✦ **Integrated Pest and Disease Management:** follows a three-component approach. First, the prevention of pest and disease spreading. Second, monitoring of pest and disease levels and detection of emerging diseases. Third, reduction of the dependency on chemical crop protection and development of integrated biological approaches for priority pests and diseases.
- ✦ **Resilient cropping systems.** Erratic weather and climate change, combined with degradation of natural resources including soils, pose a major threat to cocoa production and the livelihoods of cocoa farming communities. Building resilience requires a range of interventions, such as the adoption of climate smart practices, crop diversification including agroforestry and conservation and restoration of natural resources. Therefore, the strategy does focus on three main areas: resilient agronomy, weather-informed agro-advisories as well as enhanced natural resources and ecosystem services.

Completed Projects

Cocoa Beans: Chocolate & Cocoa Industry Quality Requirements 2nd Edition 2023

The update of the manual was completed in December 2023. It describes the cocoa bean quality requirements of the industry. Making relevant information more accessible is a key tool for communication with all stakeholders. The manual covers food safety aspects, cocoa bean and butter quality and sensory quality amongst others. The updated version is freely available in English and can be downloaded from the JRF homepage: <https://jointcocoaresearchfund.eu/>

Spatially explicit recommendations for optimal levels of shade-tree cover for sustainable cocoa production - Shade-tree project (2020-2023, Ghana).

Two machine learning models were developed to determine current shade-tree cover and carbon stocks in cocoa farms using Sentinel-2 images. The training dataset was collected over two extensive field campaigns across 828 cocoa farms. Our results indicate that cocoa agroforestry in Ghana and Côte d'Ivoire falls far below its potential, with an average of only 13.2% shade-tree cover across all cocoa areas. These maps will be made accessible on Google Earth Engine to aid in estimating shade-tree cover in cocoa farms. The source code and ground truth data will be published with two upcoming scientific manuscripts.

Shade tree density is an important tool to stabilize existing cocoa plantation regarding the changing climate and to store carbon. If more shade trees were planted, an additional carbon storage potential of 79 Tg C could be harnessed.

Ongoing Projects

Mitigation of Aluminium contamination (2022-2025, West Africa and Latin America).

The project aims are to identify major sources and entry points of aluminium contamination and to develop an effective mitigation strategy. The sampling exercise in Ivory Coast, Cameroon, Brazil and Ecuador has been completed. Farms with high contamination can now be selected for detailed studies regarding the main entry points and to test mitigation strategies.

IP-EPIC - Identifying pollinators and enhancing pollination in cocoa (2022-2026, Ghana)

Cacao productivity is constrained by inadequate pollination, and the lack of sufficient nutritional / water resources to support it.

Here we intend to systematically test four major predictions:

1. Enhanced pollination is sustainable long-term only if trees are well-resourced with moisture and fertilizer.
2. Pollinators of cacao represent a diverse insect community that includes Ceratopogonidae and other species.
3. Four conditions will increase the diversity and abundance of cacao pollinators: proximity to forest, agroforestry on farms, ample breeding material, and use of less damaging pesticides.
4. The abundance and behaviour of pollinators can be manipulated by a range of interventions, with different affordability, meaning there are strategies appropriate for different farms.

The project has been implemented in collaboration with farmers and local research partners. Cacao flower and insect samples have been collected and are currently analysed by means of meta-barcoding and physiological markers, to identify key pollinators.

Fast-tracked breeding targets for resistance to VSD and other serious pathogens of cocoa (2024-2026, Indonesia and Australia)

Vascular Streak Dieback (VSD) of cocoa is caused by the obligate fungal parasite, *Ceratobasidium theobromae*. The pathogen colonises the xylem and can cause rapid tree death in susceptible plants. VSD causes significant crop losses in Southeast Asia and the Pacific and presents a serious potential biosecurity threat to cocoa production in West Africa and Latin America.

The project brings together the latest genetic laboratory protocols, DNA sequencing and computational methods, comprising a novel protocol to locate and annotate all predicted resistance genes within any plant (Chen et al., 2023). Additional approaches, include benchtop sequencing with Oxford Nanopore MinION, permitting deep investigation into QTL regions of particular interest. The combined methods will allow us to identify specific resistance genes within VSD susceptible and resistant cocoa clones to inform breeding.

Establishment of Knowledge Bases for the 4th Edition of the Pesticides Manual and the 2nd addition of the Cocoa Bean Quality Manual (2024).

Both manuals are core elements to communicate with cocoa value chain stakeholders about cocoa bean quality requirements. Therefore, in addition to the PDF format, online Knowledge Bases are in preparation for both manuals. The work has been delayed, but the Knowledge Bases should be made available under the domain cocoaquality.eu by the end of the year. They will increase the accessibility of the information in the manuals through search engines and allow fast and frequent updates for example regarding Maximum Levels, Maximum Residue Levels and the list of pesticides.

Communication Strategy - Dissemination of Project Results

To support knowledge transfer and the application of the project outcomes, the JRF disseminates the research results via its homepage www.jointcocoaresearchfund.eu, through manuals such as the one on Cocoa Beans, through presentations at International Symposiums and through workshops with stakeholders e.g. on cadmium mitigation, in producing countries. For 2022, webinars on MOH contamination, Food Safety in general and the developed pesticides manual, are in preparation. They are jointly organised by CAOBISCO, ECA and the ICCO (the International Cocoa Organisation of the United Nations).

Progress report

Progress will be reported on an annual basis, aligned with the annual progress report of each project submitted annually to the JRF, CAOBISCO and ECA. Additional information will be also available via the [JRF website](http://www.jointcocoaresearchfund.eu).