



**International
Symposium on
Cocoa
Research**

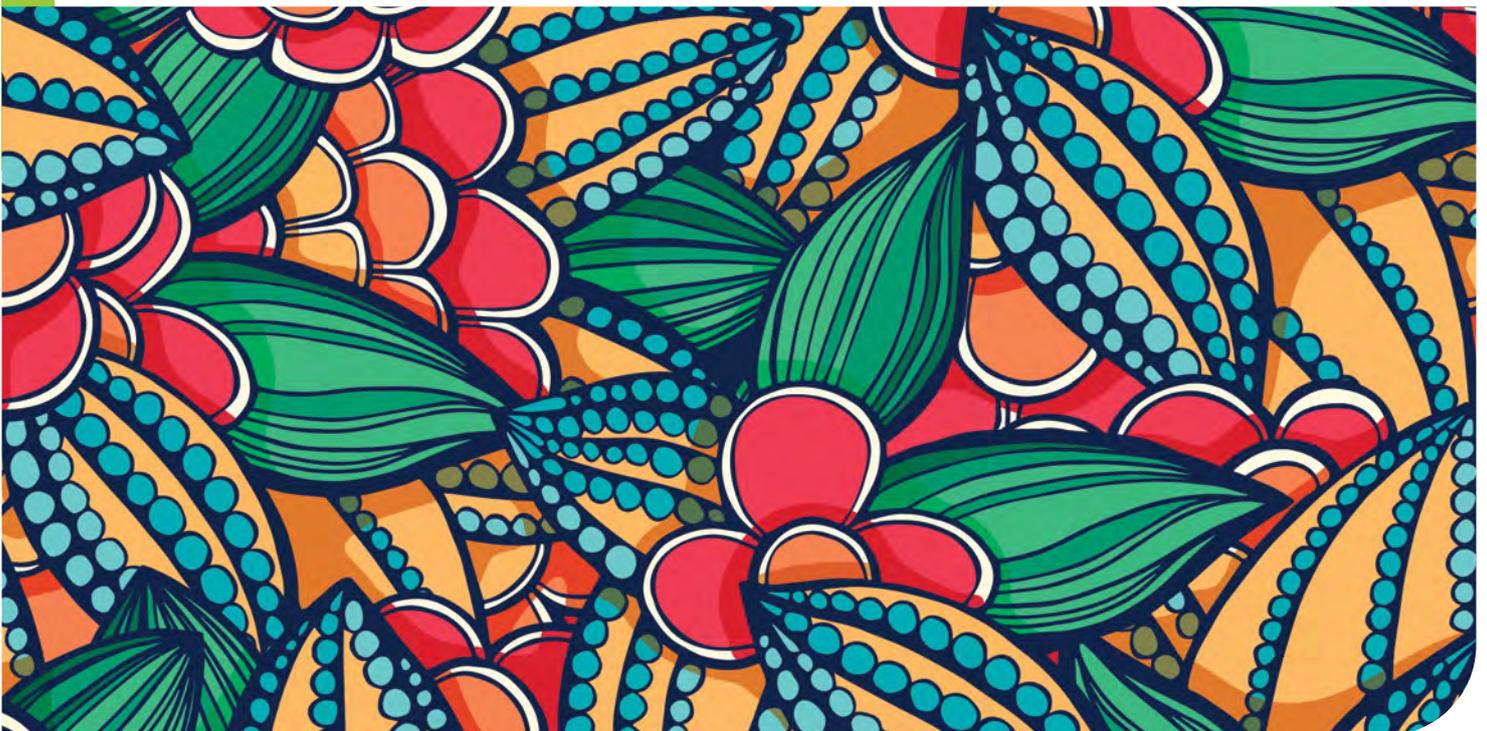
● 5, 6, 7 December 2022, LE CORUM, Montpellier, France ●

**INNOVATIONS TO SUPPORT MARKET
DEVELOPMENT AND PROMOTE
THE SUSTAINABILITY OF COCOA FARMING
FOR BETTER FARMER INCOME**

Symposium Report

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Introduction

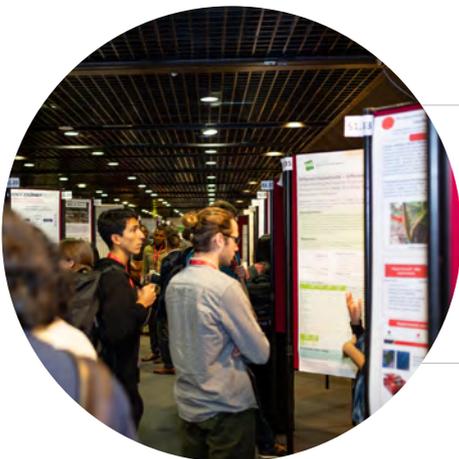
The second edition of the International Symposium on Cocoa research (ISCR) was co-organized by the International Cocoa Organization (ICCO) and the French Agricultural Research Centre for International Development (CIRAD) from 5-7 December 2022. The theme for this edition was “*Innovations to support market development and promote the sustainability of cocoa farming for better farmer income*”.



International Symposium on Cocoa Research



The symposium attracted approximately 600 attendees from around 250 organizations, including research institutions, private and public sector institutions, government and civil society organisations. 40 nationalities were represented.



In terms of cocoa research, 400 abstracts were received and reviewed by the ISCR Scientific Committee. Out of these, 75 were selected for oral presentations and 135 for poster presentations.



Symposium objectives



WORLDWIDE PLATFORM

Provide a platform for the cocoa community and scientists to exchange on the latest findings.



INNOVATIONS

Present advances in technology and innovations in the cocoa sector.



ANALYSE IMPACT

Analyze the potential impact of research results for the cocoa sector and farmer income.



RECOMMANDATIONS

Provide practical and relevant recommendations to the cocoa sector.



DISSEMINATE

Disseminate the results of this second edition of the ISCR.



COLLECTIVE ACTION

Agree on priorities for collective action.



Scientific Committee members



Bruno EFOMBAGN

IRAD, Cameroon-Chair
Cocoa genetic resources and breeding



**Yeirme Yaneth Jaimes
SUAREZ**

AGROSAVIA, Colombia
Phytopathology, microbiology, integrated disease
management and population biology.



Verina INGRAM

Wageningen University, Netherlands
Socio-economic aspects of cocoa farming and
value chain, Cocoa supply/value chain
governance, Farm diversification, Cocoa related
deforestation, Cocoa agroforestry



Philippe BASTIDE

BCC&C, France
Agrophysiology



Michelle END

CRA, UK
Cocoa genetic resources and breeding, crop
protection, quality requirements for the industry.



Mathias TAHI

CNRA, Côte d'Ivoire
Cocoa breeding and diseases resistance.



Karina GRAMACHO

CEPEC/CEPLAC, Brazil
Plant pathogen interaction; Fungal biology and
evolution, histopathology, molecular biology



Frances BEKELE

CRC, Trinidad & Tobago
Cacao germplasm characterisation management;
evaluation, utilisation and conservation,
sustainable cocoa production and farmer
livelihoods, climate change mitigation in cocoa,
diversified and optimized cocoa farming systems



Christian BUNN

Alliance of Bioversity International and CIAT,
Germany
Climate change adaptation, social-ecological
transformation, resilient value chains.



Christian CILAS

CIRAD, France
Biostatistics, Quantitative Genetics, Plant
Epidemiology



Brigitte LALIBERTE

Cocoa of Excellence, Rome, Italy
Alliance of Bioversity International and CIAT
Genetic diversity conservation and use, post-
harvest, quality & flavour, climate change and
contaminants adaptation.



Dr. Soetanto ABDOELLAH

ICCRI, Indonesia
Cocoa Cultivation, GAP techniques, Shade and
irrigation, water/soil fertility management

Opening ceremony speech extracts

Click on the badges
to listen to the extract
(internet connection required)

Introduction by Master of Ceremony,
Mr. Martijn ten Hoopen

Mr. Jean Paul Laclau

Director of the Persyst department – CIRAD

Dr Narcisse Olinga

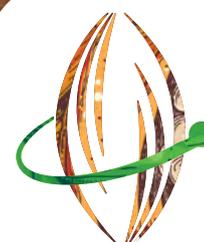
Vice Chairman of the International Cocoa Council (ICCO)

Mr. Michel Arrion

Executive Director (ICCO)

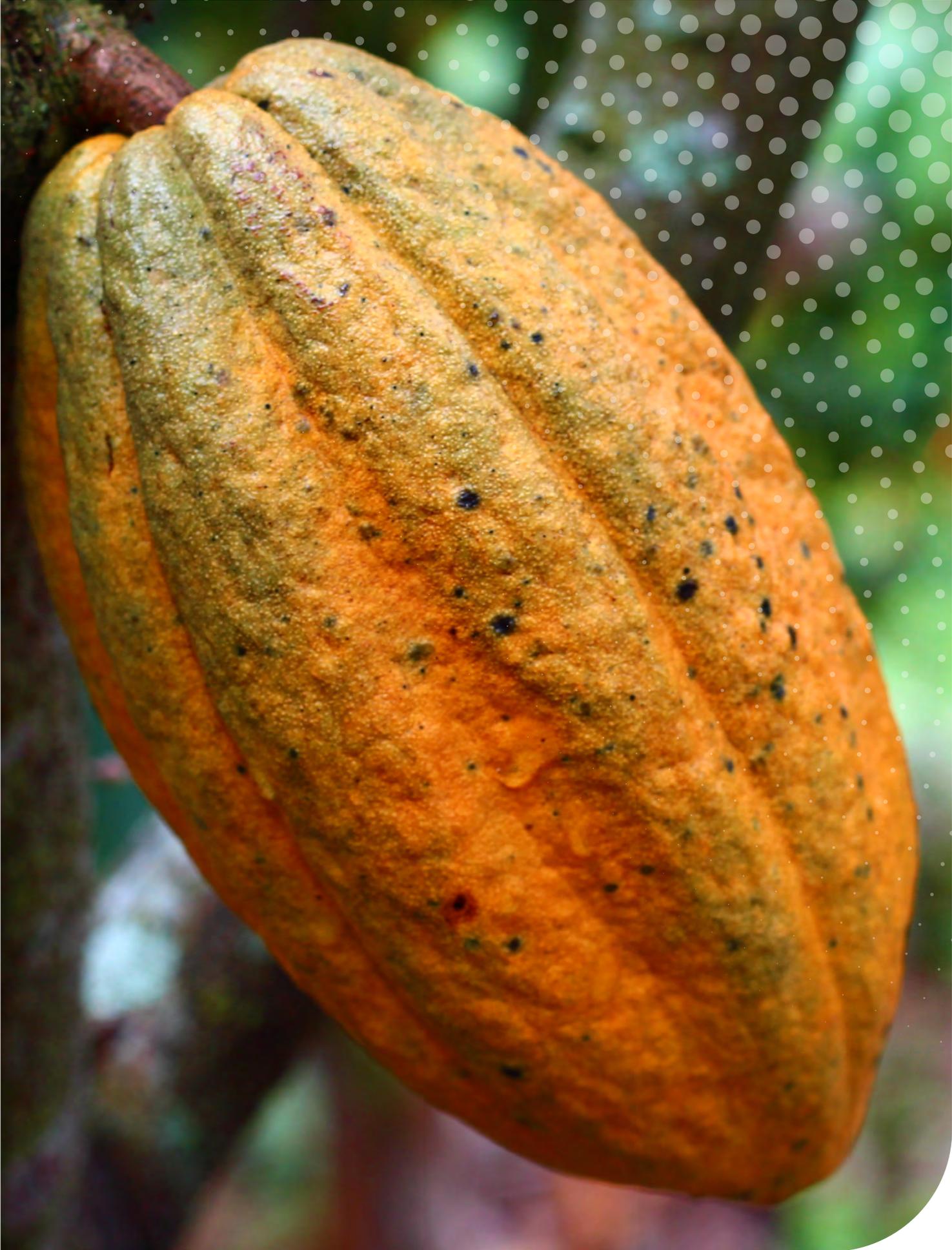


From right to left : Dr Narcisse Olinga, Vice Chairman of the International Cocoa Council (ICCO), Jean-Paul Laclau, Director - Persyst Department (CIRAD), Michel Arrion, Executive Director (ICCO) and Alain Hoffmann, Deputy Vice-President (University of Montpellier)



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Key findings and recommendations



Key findings and recommendations

SESSION 1 COCOA CULTIVATION: INNOVATIVE APPROACHES AND PRACTICES FOR SUSTAINABLE PRODUCTION



Challenges

The research presented in this session focused on (1) understanding the determinants of cocoa prices with a view to identifying the level for fairer producer remuneration; (2) increasing knowledge on soil fertility, soil degradation and soil restoration; (3) better management of pests and diseases; (4) improving agronomic practices; and (5) increasing genetic gains on different traits of interest by using molecular tools and better phenotyping.

Innovations

FARMERS' LIVING INCOME

- A novel methodology to estimate living income is presented.
- Service delivery models which combine agronomic, social and health functions may contribute to improving farmers' income (Image 1).



COCOA FERTILITY AND FERTILIZERS

- A network of large soil data from different datasets is beginning to allow recommendations for judicious use of agricultural inputs (Image 2).

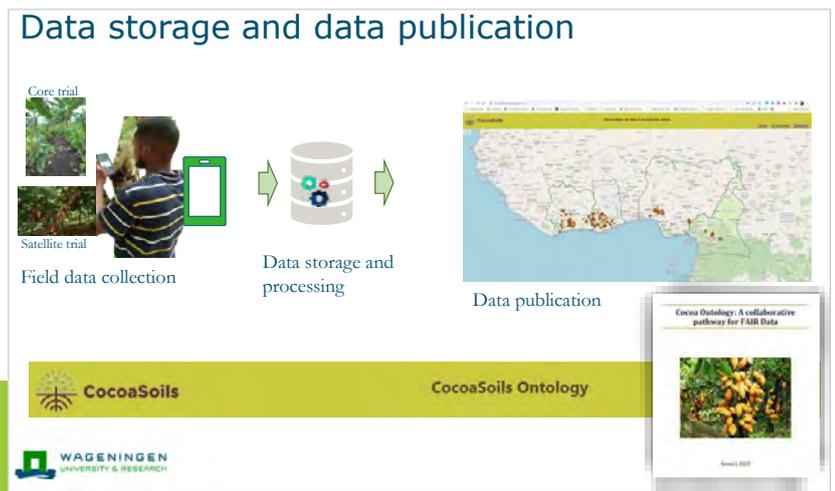


Image 2

Ekatherina Vasquez - Innovative data collection in collaborative cocoa fertilizer trials, Wageningen University & Research.

PEST AND DISEASES

- Kits used in the field to detect diseased trees without symptoms of CSSV (Cacao swollen shoot virus) have been developed. Early detection of the virus, even in asymptomatic trees, will enable identification and removal of infected trees at an early stage in order to reduce the risk of CSSV spreading to neighbouring trees (Image 3).
- Better strategies have been developed to limit simultaneous pests and diseases presence, using **barrier crops, compost associated to Trichoderma, or micro-organisms antagonist to Phytophthora species.**
- A new method to estimate yield losses from **pests and diseases** was proposed to prioritize control practices.



Image 3

Jacqueline Mary Barnett - Development of immuno assays to detect Cacao Swollen Shoot Virus, University of West of England.

GOOD AGRICULTURAL PRACTICES

- The use of **biostimulants** is an avenue to explore for a more resilient and sustainable cocoa production (Image 4).

Results: Conclusion

RESULTS

- 1 Biostimulants increased cacao yield (vs control).
- 2 **Tecamin Flower** obtained the best yield, increasing flowers, fruits and grains. This product is focused on improving flowering key period in cocoa production.

GENERAL CONCLUSION

- ❖ Biostimulants are considered as part of solution to improve agriculture sustainability and a essential partner to move to Smart agricultura.
- ❖ Fully aligned with Sustainable Development Goals (SDGs).
- ❖ Possibility to reduce agrochemicals and fertilizers to make cacao production more sustainable and environmental friendly.
- ❖ A Good partner to improve production of small scale farmer and include them in global value chain.

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AgriTecnico

Ajinomoto

Image 4

Celine Diaz - Effectiveness of Biostimulants as a sustainable solution for improving production of cocoa trees in Ecuador: enhancing flowering and fruit setting to improve final number of pods, weight and yield by tree, AgritecnoFertilizantes S.L.

BOTANY/GENETICS AND BREEDING

- **Better phenotyping** is proposed to improve tree productivity.
- **The development of molecular tools** allows for a better understanding of the history of cocoa cultivation and the genetic determinism of several quality traits.

Impact

The potential impacts of the application of these findings include better management of plantations, both in terms of technical itineraries for soils and sanitary risks, and the organization of the value chain for better remunerations for farmers. The availability of clones or hybrids, more resistant to diseases and with improved agronomic and technological qualities, will complement these advances.

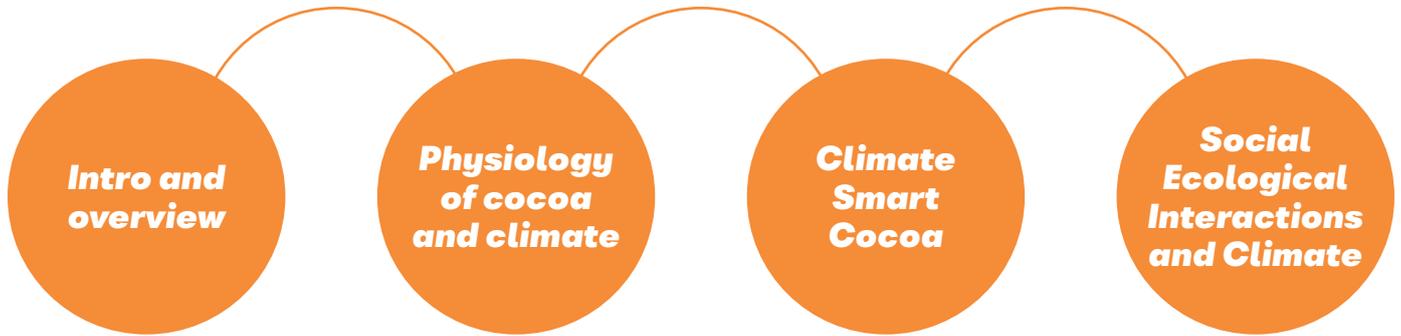
Main recommendations

- Price or yield increases alone are not enough to reach a Living Income; prices can be increased by differentiating and adding value. Moreover, to increase farmers' revenues, governments can have a stronger role than certification schemes.
- Cocoa nutrition in smallholder farms is heavily dependent on inherent soil fertility.
- The application of the strategies presented to control diseases and the validation of the models are strongly recommended as it will optimize control strategies and farmer investments. It is necessary to select clones or hybrids resistant to more than one disease, especially considering pathogen adaptation.
- There is a potential to improve yields by increasing tree health through the use of biostimulants and improved clones.
- Investigating the history (origins, domestication, geographical spread) and diversity of the cocoa species may generate useful information in the development of cocoa varieties with particular and rare useful traits.
- The use of genomic selection coupled with improved phenotyping should allow for significant genetic gains. There are new insights into the development of fine flavour quality through the identification of promising cocoa genotypes with high flavour potential.

Key findings and recommendations

SESSION 2

SUSTAINABLE COCOA AND CLIMATE CHANGE: THE WAY FORWARD THROUGH MITIGATION AND ADAPTATION



Challenges

The cocoa sector is increasingly challenged to confront climate change and to reduce emissions. Climate change is often considered a complex topic, which has the potential to impact livelihoods of cocoa producers. Complex problems, combined with a perceived downside risk, often result in a lack of urgently required actions.

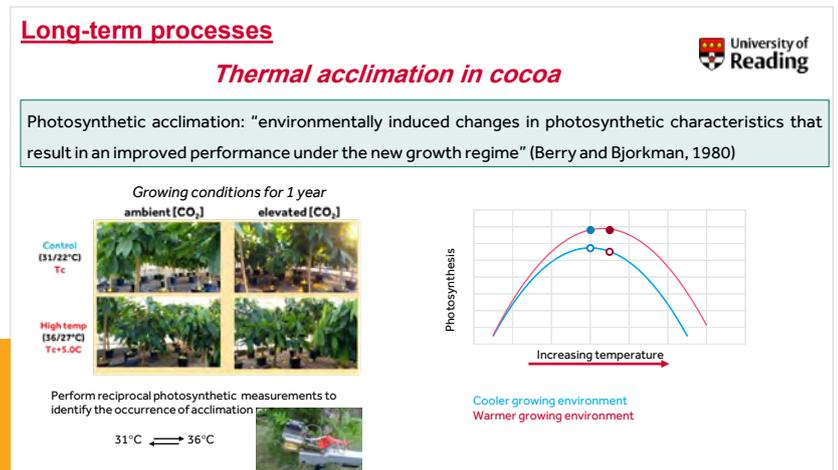
Innovations

INTRO AND OVERVIEW

- **Climate action in the cocoa sector requires a systems approach**, which considers elements of cocoa production at different scales and times and under specific environmental conditions.
- Long term climate change may be **mitigated by rising CO₂ fertilization effects (Image 5)**.

Image 5

Fiona Lahive - The importance of empirical data in accounting for the long-term and interactive effects of climate change on cocoa, University of Reading.



PHYSIOLOGY OF COCOA AND CLIMATE & CLIMATE SMART COCOA

- On a shorter timescale, **climate extremes may require adaptive management** to reduce drought impacts. This could be done via adaptive shade management, smart consideration of flowering periods or crop diversification and through integrated production systems, like those combining cocoa cultivation and aquaculture (**Images 6 and 7**).
- Common shade trees associated with cocoa may be more at risk from climate change than the cocoa plant itself, and this warrants appropriate research to select suitable species for agroforestry.

Image 6

Surja Chakrabarti - Exploiting the Cocoa genetic variation for flowering time and pod development period for climate adaptation: relationship to selected yield components, Cocoa Research Centre, The University of The West Indies.

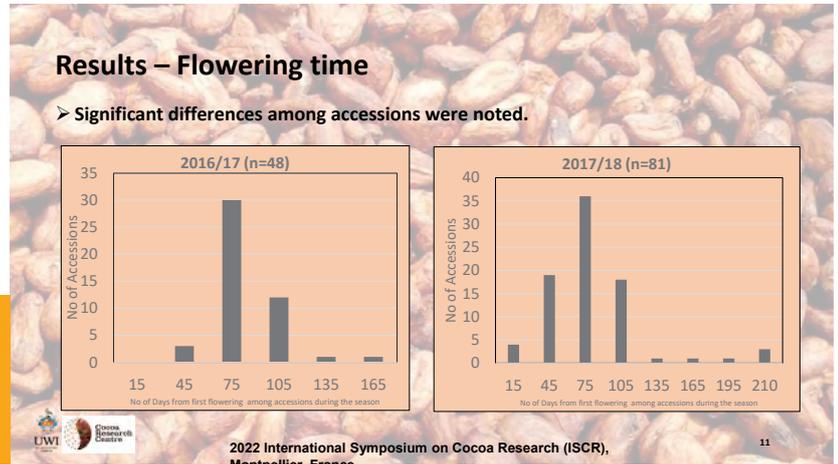
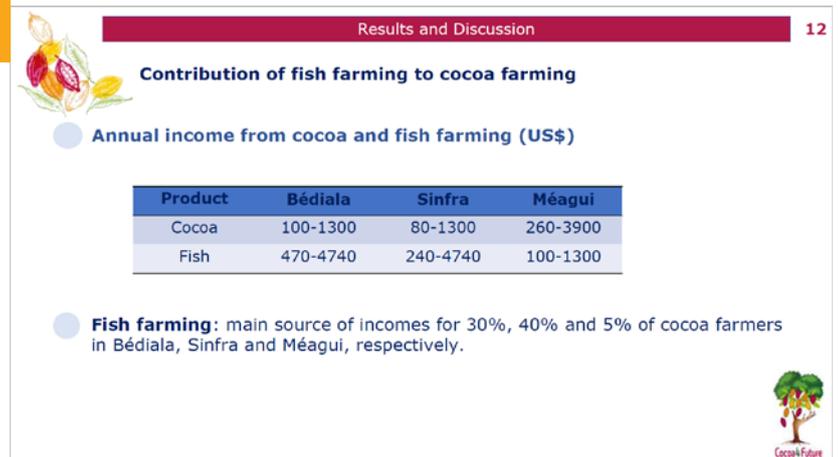
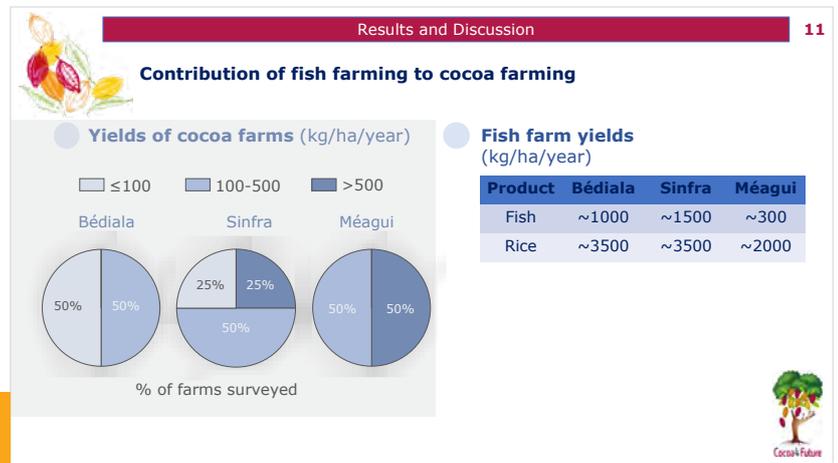


Image 7

Antoine Kouamé Kouadio - Fish farming as a way for diversifying sources of income in the cocoa sector in Ivory Coast, APDRA Pisciculture Paysanne.



SOCIAL ECOLOGICAL INTERACTIONS & CLIMATE

• **Diversification in agroforestry systems** has the potential to improve farmer income, support soil regeneration, capture carbon and provide ecosystem services such as promotion of pollination efficiency. However, value chain development is needed to maximize income from non-cocoa products from agroforestry systems (**Image 8**).



RESULTS: Income cocoa and diversification



Table 8: Income by household

	Income of producer with cocoa and diversification	Income of producers with only cocoa
Percentage	74.14%	26%
Income (US Dollar)	3779.22	2033.85

- Of the producers surveyed, 74.14 practiced diversification compared to 26 who lived solely from cocoa. Thus, in terms of income, producers who adopt diversification have two times higher than the producers that do not diversify

Image 8

Bonna Antoinette Tokou - Accompanying Research on Strategies for Income Improvement of Farming Families and Sustainable Cocoa Production in Côte d'Ivoire. University Félix Houphouët Boigny (UFHB) and Leibniz Centre for Agricultural Landscape Research (ZALF).

• Multiple authors argued that **agroforestry solutions are context specific** and depend on individual farm settings. For example, shade tree preferences may differ by gender (**Images 9 and 10**).

Main results stemming from surveys on cocoa production, climate change impacts and existing agroecological adaptation practices



Women face barriers that hinder their adoption of certain agroecological adaptation practices and hinder the recognition of their environmental leadership



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Image 9

Renée Brunelle - Implementing agroforestry systems in cocoa production as climate change adaptation methods - Case study from Ivory Coast, SOCODEVI.

Point of departure: gender-differentiated cocoa farming

- Important **differences** between cocoa farms managed by **women and men**
- **Women-managed cocoa farms** with scattered distribution of cocoa, timber trees and abundant food crops
- **Men-managed cocoa farms** mostly **monospecific**



Image 10

Dietmar Stoian - Diversity, Resilience and market orientation: A private-sector driven approach to cocoa agroforestry in Ghana, CIFOR-ICRAF.

• Empirical research exemplified that cocoa farmers are concerned about climate change and are willing to act, yet **only 3% were found to implement adaptive measures**.

Impact

The sector, given in particular its sustainability objectives such as a fair income, biodiversity and climate smart production will likely be affected by climate change impacts. Currently, in spite of the recognized climate challenges, only few producers were found to implement the required activities. The session clearly demonstrated that agroforestry-based solutions for adaptation and mitigation exist, and that they have the potential to improve livelihoods.

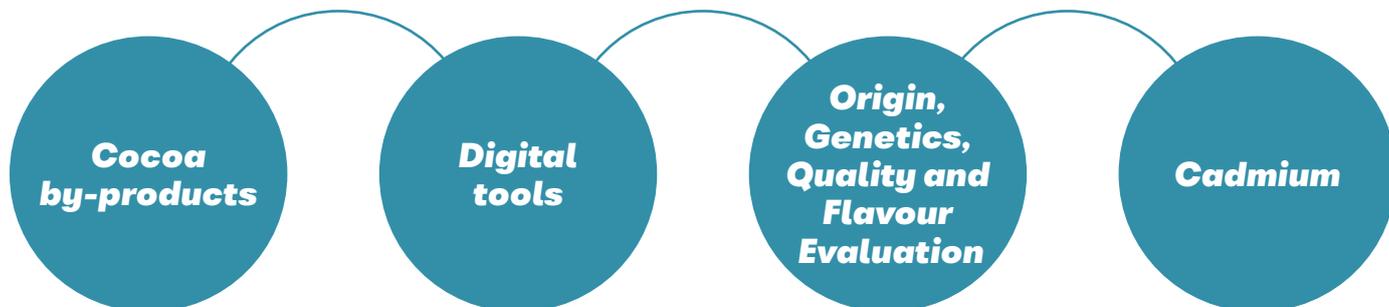
Main recommendations

- Future work should consider better delivery and scaling mechanisms, including the conduct of field trials to complement greenhouse studies, and investigate land use conflicts, so that the proposed solutions can reach and benefit cocoa producers.



Key findings and recommendations

SESSION 3 INNOVATIONS TO SUPPORT THE COCOA PROCESSING & MARKET DEVELOPMENT



Challenges

The main challenges addressed by the research presented in this session focused on making full use of all parts of the cacao plant. This includes parts normally discarded, creating markets and value addition at origin for new products and understanding aspects of market development and connecting market requirements to on-farm postharvest practices. It also looked at gaining a better understanding and improve quality through good and accurate flavour descriptions, providing practical, economic solutions for cocoa farmers to apply and reduce cadmium uptake in cocoa beans, and understanding the digital divide and impact on farm management and farmer incomes.

Innovations

COCOA BY-PRODUCTS

- Increase incomes and profitability through a **circular economy** with the example of **the use of the cacao pulp in chocolate formulation or as a juice in powder and ice cream products**, and the associated potential positive impact on the fermentation period and quality of the beans (Image 11).
- **New markets are developing for new products** which target chefs to ensure adoption.
- **Husks and pods, previously seen as by- or waste products, are also increasingly being marketed as separate products to add value**, especially at farmer and cooperative level, and leading to the creation of new small enterprises. The impact of removing part of the biomass from the cocoa production system has been little researched.

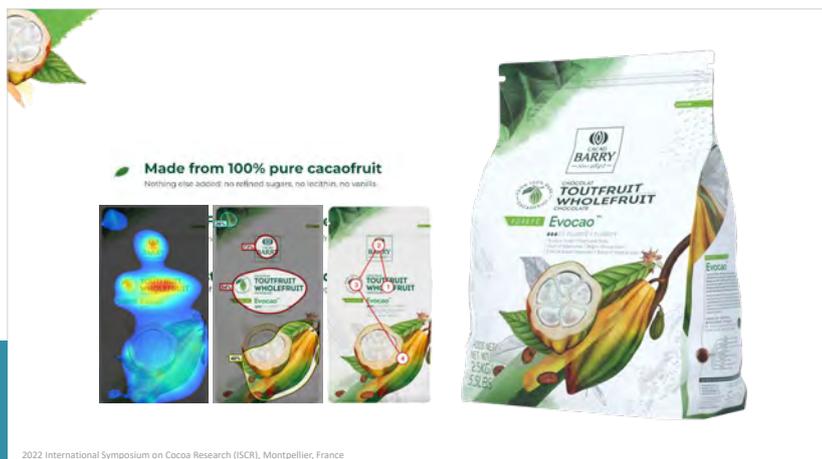


Image 11

Keynote presentation made by
Andrea Doucet Donida,
Cacao Barry Global Brand Leader.

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DIGITAL TOOLS

- For technologies to be practical and accessible, **a good understanding of the digital capacity, particularly the use of cell phones is crucial.** The impact of digital tools is still to be realised.

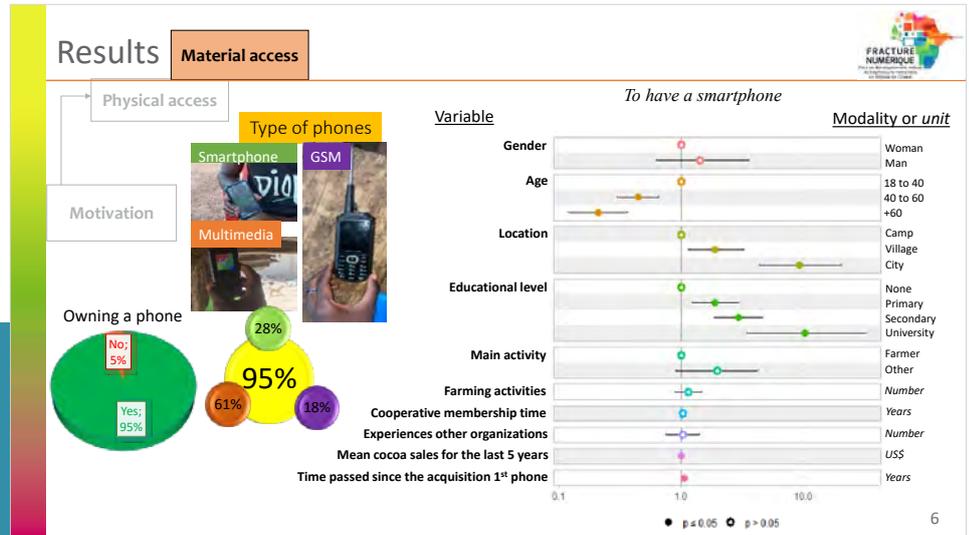


Image 12

Martin NOTARO - Characterisation of the digital divide and assessment of the impact of the use and non-use of digital tools in the Ivorian cocoa sector, CIRAD.

ORIGIN, GENETICS, QUALITY & FLAVOUR EVALUATION

- Increased number of **initiatives connecting quality requirements at farm level with national cocoa quality laboratories** which provide feedback to producers and knowledge on postharvest improvement. This includes the production of high-quality cocoa butter from unfermented beans.
- **Building the capacity of national experts to carry out sensory evaluation in an internally aligned manner** is critical, and tools are available to support this development (Image 13).
- **Connecting the sensory quality to the chemical compounds** contributes to a better understanding and impact of postharvest processes.



Image 13

Fernando Antonio Teixeira Mendes, First Sensory Map of Cocoa Almonds in the State of Pará, Brazil, CEPLAC.

CADMIUM

- Develop research leading to an **improved understanding of the mechanisms for uptake of cadmium**, and the **technologies and tools to reduce it**, including the development of low accumulating planting materials and specific mitigation recommendations (**Image 14**).
- **More accurate understanding of dietary exposure** due to cocoa and cocoa products, taking into account bioavailability as well as consumption data.

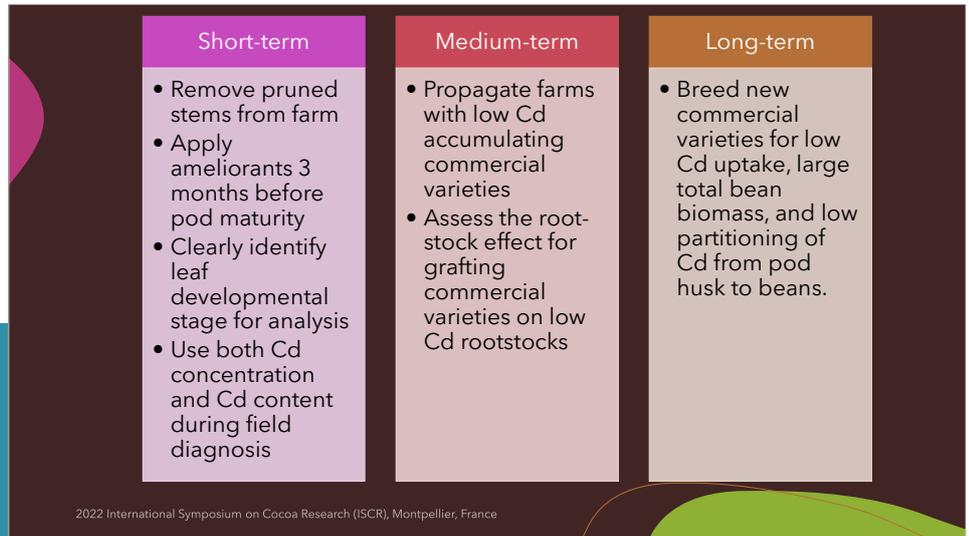


Image 14

Caleb Lewis - Understanding cadmium accumulation in cacao and its implications for developing tools for mitigation of cadmium in cocoa beans, Cocoa Research Centre and Department of Life Sciences.

Impact

These innovations, if adopted, could lead to increased added value for a growing number of products particularly at the local level, increased participation of youth and women in the value chains starting at the farm and cooperative level, increased local investment capacities based on increased value and market access, capacity to better predict and increase quality through better understanding of the key impacting processes. The latter includes facilitated access to improved planting materials, practical and economic mitigation solutions to reduce the uptake of cadmium.

Main recommendations

- Further develop appropriate, accessible and economical technologies for processing by-products with increasing market and value-addition, reduce waste while understanding the impact on cacao quality, build capacity in marketing of new products and create demand.
- Greater focus on the role of women and the youth, entrepreneurs and end users (e.g., chefs) as key agents of change, and also continue to focus on capacity building of producers at origin to develop and target the quality and flavour required by markets.
- Reconsider the links between origin and quality, to improve market access for all producers of quality cocoa, wherever they may originate from.



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