



The CocoaSoils Program (a Norwegian Government-NORAD funded initiative), a public-private consortium has been created to address the issues of decline in productivity in cocoa and improve the livelihoods of smallholder cocoa farmers, while avoiding deforestation. The program has two main arms: Research for Development (R4D) and Partnership for Delivery (P4D). The R4D focuses on developing the protocols, establishing trials as well as data collection and management, while the P4D focuses on disseminating the recommendations from these trials in order to empower farmers and improve their livelihoods. This edition of the CocoaSoils Gazette spells out the R4D agenda of the program.

COCOASOILS RESEARCH FOR DEVELOPMENT AGENDA

Partners of the CocoaSoils program are setting up 'Core and Satellite Research for Development' Trials to help provide site specific Integrated Soil Fertility Management (ISFM) recommendations across West Africa.

The Core Trials are long-term controlled trials of at least two hectares, where fertilizers will be applied in different quantities and combinations, and responses in yield will be carefully measured. These fields would each be equipped with drip irrigation systems. The objectives of the Core Trials are to generate knowledge on cocoa nutrition; serve as a basis for recommendations to be incorporated in extension messages. There are currently 10 confirmed Core Trials sites across the world which are being undertaken by National Research Institutes in West Africa and chocolate manufacturing companies. There are 8 sites in Africa, 1 in Latin America and 1 in Asia as shown on the map and in Table 1.

The experimental design for these Core Trials is a Four-Rate Reduced Factorial, with a minimum of two replicates of the treatment structure (including controls and omission plots). Four equally-spaced nutrient rates at 0, 50, 100, and 150 % of the modeled off-take are proposed.

OVERVIEW:

- CocoaSoils Research for Development Agenda
- Developing CocoaSoils Protocols
- CocoaSoils OpenData
- Collaborative Research
- CocoaSoils Launched in Côte d'Ivoire
- Special Feature : CocoaSoils PhD student in Wageningen

In addition to the Core Trials, Satellite Trials will be set up in farmers' fields to test different fertilizer combinations and shade interactions to examine the effects on yield under field conditions. The Satellite Trials will be a link between the perfectly managed core trials and farmer managed cocoa plantations. The program will work with a range of 20 Satellite Trials per country with about 400 to 500 farmers in total.

The results from these trials will inform recommendations that will be delivered to farmers through a Partnership for Delivery mechanism that utilizes existing service delivery channels by both public and private sector partners to achieve better yields, improve sustainability of cocoa production and the livelihoods of smallholder cocoa farmers.



Core Trial Locations

Table 1. Status Update of Core Trial sites

COUNTRY	GPS	IMPLEMENTING	CURRENT STATUS
LOCATION	COORDINATES	PARTNERS	
CAMEROON BOKITO	04°51'26.5"N 011°11'9.0"E	IITA	Manual clearing and cleaning have been done and site is ready for planting of maize and plantain
CAMEROON NKOEMVONE	03°58.746'N 009° 46.807'E	IRAD	Site was manually prepared. Maize and plantain have already planted with maize almost ready for harvesting
CÔTE D'IVOIRE ABOISSO	X = 498592 Y = 607929	NESTLE	Site has been manually cleared, pegged. The planting of maize is scheduled between mid and end of August 2018
CÔTE D'IVOIRE DIVO	05°59.404'N 005°14.317'W	CNRA	Site manually cleared with lining and pegging done. The planting of maize and plantain has stalled due to the cessation of rains in July 2018
CÔTE D'IVOIRE TIASSALE	N 05°55'04.2" WW 004°52'05.0"	BARRY CALLEBAUT	Topographical mapping of one proposed site has been done with another one currently on-going. Detailed work will follow as soon as the mapping is completed
ECUADOR	NOT AVAILABLE	MARS	Work in progress
GHANA MABANG	6° 59' 44.646" N 2° 14' 9.204" E	CRIG	Site has been manually cleared. Maize and plantain are scheduled to be planted in September 2018
INDONESIA	NOT AVAILABLE	MONDELEZ	Work in progress
NIGERIA IBADAN	7°30' 29" N 3°53' 33	IITA	Site has been cleared. The planting of maize and plantain has been delayed due to the short rainy season in Nigeria in 2018
NIGERIA OWENA	07.20063°N 005.02767°E	CRIN	2 hectares of the site has manually been prepared for planting of maize and plantain. Work still on-going for the remaining 1 hectare. A total of 6000 seedlings has been raised in a newly constructed nursery for the project.

Developing CocoaSoils Protocols

In order to get the best possible growth and yield in the CocoaSoils Core Trials, and to be able to compare the results between the different locations, the trials are conducted following strict protocols. Over the last months, the protocols for field preparation and nursery management have been finalized and the protocol for field planting has been prepared and discussed. The different practices in the protocols have been the topic of intense debate. For example, a planting distance of 2.5 by 3 meters is probably good for rapid canopy closure and productivity in earlier years; a distance of 3 by 3 m is better for vigorous crop growth and to prevent between-tree competition in later years; and a distance of 2.5 by 4 m is common in Latin America because it allows for mechanization of practices such as pruning.

In the end, the protocols are a best-bet and a compromise between the recommendations from the large group of knowledgeable agronomists who are involved in CocoaSoils.

The finalized protocols have been stored in an online Protocol repository where the partners can access and download them. An excerpt of the Field preparation protocol is shown below:

Field preparation

To prepare the field sites, the following activities need to be carried out:

- *Remove all existing shade (manually)*
- *Remove small pieces of root matter manually where possible*
- *Cut large stumps to the ground and treat with an arboricide*
- *Establish drainage canals as set out in the field map*
- *Sow a continuous un-fertilised uniformity maize crop (below)*

Apart from protocols which describe crop management, there is a second set which focuses on data collection. One of the main objectives of CocoaSoils is to collect a full set of relevant data from the wide range of well-run trials, and to make this data publicly available. Over the last weeks, the first field maps and Digital Elevation Models have been sent in to Wageningen, showing the size of the fields and the slopes that are present.



Extract of the Digital Elevation Model

Some soil profiling was done ; plantain has been planted; nurseries have been established; and the first uniformity maize crop is almost ready for harvesting. The data team at Wageningen University and Research and the research assistants in Africa are working on getting a complete overview of which data needs to be collected when, where, and how.

The first maize will be harvested in Cameroon by the end of August, and the data sheets must be ready to make sure that all the data is captured in an efficient and complete way.

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CocoaSoils OpenData

Over the last decade open data was mostly provided by governments, who developed pro-active data sharing policies. Recent years have also seen a change to private and research actors taking a pro-active role in sharing data of their activities. CocoaSoils is a good example of supporting data driven innovation by making data available. The structure of CocoaSoils which incorporates innovative data management solutions and techniques sets CocoaSoils apart as a unique program. Within the framework of CocoaSoils an open-data approach is adopted as the core of its data management system.

The CocoaSoils consortium noted early on in its development that data on cocoa responses to fertilizer or data from cocoa field trials was mostly unavailable, and thus no synthesis work could occur over larger number of trials or time. CocoaSoils thus adopted an active open data approach, which has implications in organizational, technical and cultural terms. This approach to open data will allow data to flow between partners in order to standardize and somehow centralize data from the field trials. This will allow publication of the data to occur in a structured way according to a well described procedure. Wageningen University and Research builds this centralized approach jointly with partners and they agreed on a joint publication strategy and licensing.

In terms of technical support, a data collection app is being developed to allow data to be stored according to jointly agreed naming schemes and variable definitions, so that there is consistency in the data collection. This app will run on android devices and collect data on the trial sites (location, weather, soils), growth of the cocoa crop (size, pod-development, yields), and management of the cocoa tree (fertilization, spraying, irrigation).

Finally, open data and data sharing of cocoa trial data is new to most partners in the partnership and for the industry at large. CocoaSoils will thus create a data and knowledge platform on which data can be downloaded, summarized and used as a reference point on cocoa data, to promote innovation within the sector.

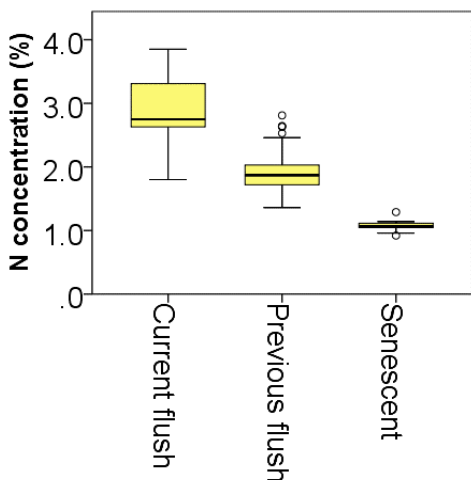
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Collaborative Research - CocoaSoils/NWO-WOTRO

Destructive cocoa tree sampling in Côte d'Ivoire

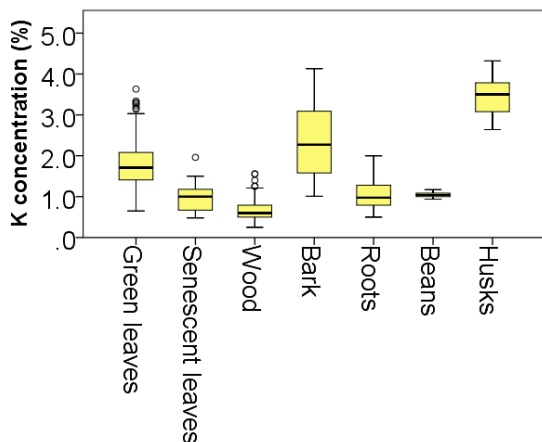
For the NWO Wotro project in collaboration with Mondelez, the Wageningen MSc student Fabián Calvo Romero worked with Dr Emmanuel Kassin at CNRA, Divo, Côte d'Ivoire to analyse the biomass and nutrient content of cocoa trees. His results were very useful for CocoaSoils as well, so we would like to share three highlights.

Fabián and his team of 10 workers dug up all the roots of the trees so he could get a complete picture of the distribution of biomass and nutrients over the different parts of the tree, above-ground and below-ground.



Graph 1: Nitrogen concentration in leaves from the current flush, the previous flush, and in senescence.

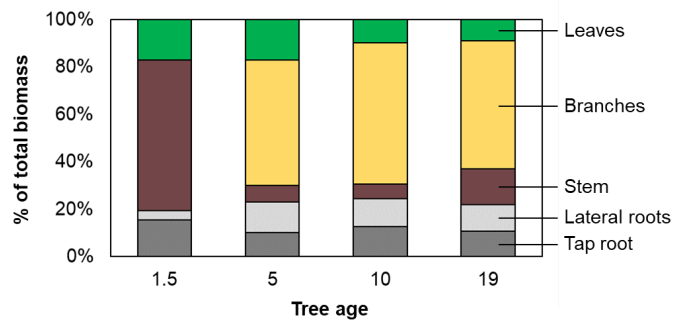
Graph 2 shows the distribution of potassium over the different plant parts. There are particularly large amounts of potassium in the husks, but the bark and the green leaves also contain much potassium.



Graph 2: The distribution of Potassium over different parts of the cocoa tree

Graph 3 shows the biomass distribution over the different vegetative tree parts at the time of the experiment. The roots are relatively poor in potassium, but their biomass is significant: between 20% and 25% of the total vegetative biomass was found in the roots, irrespective of tree age. When the trees grow older, the relative weight of the leaves goes down from around 20% to around 10% of the total biomass, although of course this depends on the season as well.

With this and other data from Fabián, we can improve the nutrient balance model, which will be used as one of the tools for calculating the nutrient requirements of the trees in the CocoaSoils Core Trials.



Graph 3: The biomass of the different vegetative parts of the tree, relative to the total biomass at various tree ages

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CocoaSoils Launched in Côte d'Ivoire



As part of its four in-country launches, the CocoaSoils program has been launched in Côte d'Ivoire. The program dubbed, « Intensification de la production durable de cacao par le développement et la diffusion de la gestion intégrée de la fertilité du sol » took place at the Headquarters of the Centre National de Recherche Agronomique (CNRA), in Abidjan on July 24, 2018.

The two-part program was patronized by over 40 scientists and key partners. Partners present included CNRA, Nestle, ICRAF, IDH, Mondelez, ICCO, IRAD, CEMOI, Timac-Agro and ANADER. The Program was chaired by Dr. Abdoumramane Sangre, the Director General of CNRA, who in a speech stated that "I am especially excited about this project because it is not in one country but being undertaken across the West African region. Also we are bringing all the important stakeholders at the table". The program also featured a speech and a presentation by Dr. Richard Asare, the Coordinator of the CocoaSoils Program, who gave a general overview of the project and the agenda of the program.

The program ended with a technical session, where participants debated on varying scientific questions with regards to the project protocol design, the CocoaSoils partnership as well as its extension and dissemination tools.

Paulina Ansa Asante - Ph. D. Student on CocoaSoils

Paulina Ansa Asante from Ghana, is a PhD student at both Crop Systems Analysis and Forest Ecology Management research groups of Wageningen University and Research (WUR), Netherlands. Her PhD research aims to “Analyze Climate Change Effects on Cocoa Production and their Potential Consequences for Forest Conservation”.

This research study is being done in partnership with The International Centre for Tropical Agriculture (CIAT) and International Institute of Tropical Agriculture (IITA). It is meant to improve understanding regarding possible impacts of climate change on cocoa production



Paulina Ansa Asante, PhD student on the CocoaSoils Program

and associated risks for forest conservation. It aims to improve knowledge on how climate change is affecting cocoa yields and its consequences on forests. This would influence decisions on better agricultural practices that could improve sustainable production under different climate regimes. Such knowledge would help the cocoa farmer to build resilience, improve yields under climate change whilst safeguarding forest and biodiversity

As personal background information, Paulina completed her bachelor studies at the University of Ghana in 2012 and worked three years at the Remote Sensing and Geographic Information Systems (RS/GIS) lab unit of the same university. In 2015, she enrolled in the MSc Geo-information & Earth Observation for Natural Resources Management, Forestry, Agriculture and Environment program at the Faculty of Geo-information & Earth Observation (ITC), University of Twente, The Netherlands. She completed her Masters in 2017. Prior to her enrollment now as a PhD student, she also worked with the RS/GIS unit and also Climate Change and Sustainable Development Unit of the University of Ghana as a teacher, a researcher and also offered consultancy services.

Paulina enjoys teaching, research, particularly in spatial analysis and modelling, loves to sing in church and writing motivational notes.

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Upcoming Events

The CocoaSoils Program launch in Cameroon

Date: Tuesday, September 04, 2018

Time: 9:00 am

Venue: Conference Room at the DVI of the Institute of Agricultural Research for Development (IRAD) in Nkolbisson, Yaoundé

The CocoaSoils Program launch in Nigeria

Date: Tuesday, October 16, 2018

Time: 9:00 am

Venue: Conference Room of the Cocoa Research Institute of Nigeria (CRIN) Ibadan

The CocoaSoils Annual Forum

Date: 3 - 6 December 2018

Venue: Accra, Ghana

CocoaSoils Discussion Forum

What are your burning questions about enhancing cocoa production, maintenance of soil fertility, the challenges facing smallholder cocoa farmers, etc?

The CocoaSoils team has access to a very wide range of scientific and business expertise through the many partner institutions and companies who are collaborating. Please pose your questions to the coordinator at R.Asare@cgiar.org and we are open to a discussion in the next edition of our newsletter.



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