

# Integrative alternatives for reducing cadmium (Cd) concentration in cacao beans in Latin America and the Caribbean

Implementing multidisciplinary approaches to enable/maintain access to regulated markets (Cd) of cacao originating in LAC, thereby contributing to the sustainability of the regional cacao sector.



Sustainable cacao for Latin America and the Caribbean

## The implemented initiative

The main objective of this platform is to promote the use of research and innovation for the sustainable production of cacao in LAC countries, with due attention to quality and achieving low Cd levels, enabling participation in international markets. To fulfill this objective, the platform is organized into four components: 1) genetics and plant nutrition to lower Cd in cacao plants, 2) strengthening laboratory capacity

and technology to mitigate Cd in cacao, 3) organize the cacao value chain to reduce the effect of Cd in cacao and 4) knowledge management. The platform performs in an interdisciplinary manner to reduce cadmium concentration in cacao beans by at least 30% through the application of soil amendments and/or selection of cultivars with low Cd uptake capacity.

Sustainability of the cacao supply chain through the use of scientific research and innovation for positioning LAC cacao as high quality and low cadmium

## The technological solution

Cadmium is a naturally occurring element present in soils at concentrations < 0.40 mg of Cd per kg of soil (worldwide average). In cocoa plants, this concentration can increase by 4 and 2 times in leaves and beans, respectively. The platform focused on strengthening laboratory analytical capabilities through the incorporation of analytical and quality control systems

(QA/QC). Samples were collected to determine sites with high and low Cd concentrations and to create maps. Trials (field and controlled conditions) were implemented to evaluate the influence of genetic factors on Cd absorption. Finally, six field trials were conducted where soil amendments and microorganisms were applied to reduce Cd in cocoa beans.



**2119**  
Participants in training activities.



**686**  
Trained women.



**6**  
Experimental farms established by the platform.



**3**  
Annual workshops developed.



**1**  
Approved and standardized laboratory methodology.



**3**  
Cd level dot map.



**4**  
Database of the network's



**12**  
Cd handling guides



**1**  
Protocol for the asexual production of cocoa



**4**  
Paper published

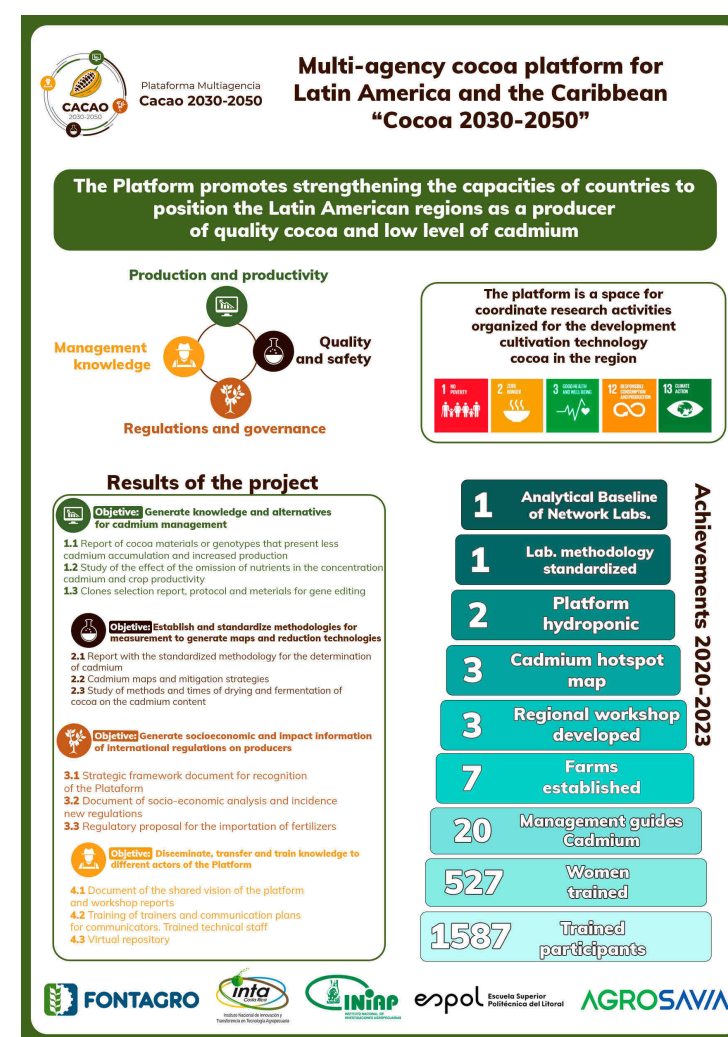


**1**  
Socioeconomic study of the cocoa value chain.



**7**  
Database of cacao varieties evaluated on cadmium absorption

### Project infographic



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## Results

A standard laboratory protocol was established, focusing primarily on quality parameters such as the use of certified reference materials. Spatial determination (mapping) of Cd-contaminated areas was carried out by collecting samples from 150, 600, and 570 cocoa farms in Costa Rica, Colombia, and Ecuador, respectively. A high variability was observed among countries and within regions of the same country, making it difficult to accurately determine Cd contamination in cocoa-

growing areas. Extrapolations would be erroneous due to the prediction uncertainty of the maps (> 30%). So far, the best agronomic alternative for Cd management is soil pH increase through the use of agricultural lime. Reductions of up to 50% compared to non-application (control) can be achieved; however, this is achieved gradually and may take two to three years to observe results.