CADMIUM (Cd) ISSUES IN CACAO CROPPING SYSTEMS V. C. BALIGAR

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Importance Fuentes Absorción Actualidad Futuro

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amending Regulation (EC) No 1881/2006 as regards maximum levels of cadmium in foodstuffs

(Text with EEA relevance)



ImportanceFuentes Absorción Actualidad Futuro

The Annex to Regulation (EC) No 1881/2006 is amended as follows:

(1) Subsection 3.2. (Cadmium) is replaced by the following:

Cadmium

'3.2

Specific cocoa and chocolate products as listed below (49)

- Milk chocolate with < 30 % total dry cocoa solids
- Chocolate with < 50 % total dry cocoa solids; milk chocolate with ≥ 30 % total dry cocoa solids
- Chocolate with \geq 50 % total dry cocoa solids
- Cocoa powder sold to the final consumer or as an ingredient in sweetened cocoa powder sold to the final consumer (drinking chocolate)

(10 as from 1 January 2019)
(30 as from 1 January 2019)
(80 as from 1 January 2019)
(60 as from 1 January 2019)

Comercial



WHAT IS CADMIUM (Cd)?

- Atomic number : 48; Atomic mass: 112.4 g.mol⁻¹
- Cd is one of the most toxic trace metals found in the environment
- Cd is a trace metal without essential biological functions. It is toxic to plants, animals and humans at low concentrations.
- Cd does not have any essential metabolic functions in plants

Cd EFFECTS ON CROP PRODUCTIVITY

- Plant Physiology: Inhibition of photosynthesis, enzyme activity and protein synthesis, oxidative stress, low yields
- Nutrition disorder: antagonistic effects on the uptake and transport of essential nutrients (K, Ca, Mg, Fe, Mn, Cu, Zn)
- Nutrient imbalance: antagonistic effects on the availability of other cations, particularly trace elements (Fe, Mn, Cu, Zn).
- Food contamination: heavy metal accumulation in edible parts, such as cocoa bean Cd.

SOURCES OF HEAVY METALS

Natural, Geogenic, Anthropogenic [He et al.,2015 Adv Agron134:135-225]

NATURAL

Gases from Volcanic Eruption Rain and Snow Forest Fires Marine aerosols Windblown particles

GEOGENIC

Soil pedogenic (Lithogenic) Weathering of soil Parent materials

Igneous rocks > sedimentary rocks

- Basic rocks > neutral> acidic rocks
- Fine sedimentary > coarse sedimentary

ANTHROPOGENIC Fertilizers and Pesticides Lime Irrgation Water Biosolids Automobile Mining-Processing/ Smeltering Fossil Fuel Combustion

Regulatory standards for Cd in Agricultural soil (mgkg⁻¹)

Country/Region	Cd
Australian	3
Canada	3
China	0.3-0.6
Germany	5
Taiwan	5
Tanzania	1
Netherland	13
NZ	3
UK	1.8
USA	0.43

Soil Factors Affecting Cd Availability



Phosphorus Fertilizer on soil Cd

(Bolan et al., 2004)



Relationship between Soil Cd and pH (Eduardo, 2016)

■ S1 S2 ▲ S3



Cd concentrations in beans and husks-Honduras (Engbersen Nadine 2017)



Average Cd content (mg kg⁻¹) Cacao Cultivars [SPA-9, POUND-7, IMC-67]: Roots -3.31 Rootstocks- 3.21 Young branches- 4.78 Adult branches- 5.55 Leaves- 2.55 Young husks-3.18 Beans -3.020

Branches > roots> Leaves > Bean Soils: (0.59 – 1.12 mg kg¹)

Bean Cd contents were well above the critical level

Concentration of Cd in cocoa beans (mg/kg) (Bertoldi et al. 2016)

West Africa	0.093
East Africa	0.508
Asia	0.328
South America	1.388
Central Americ	0.544

FUTURE CHALLENGE

Inter-disciplinary and Multi-institutes (National/International) Approaches are Required in Devising Strategies at Multiscalar levels to Resolve Cd Remediation Issues in Cacao Cropping Systems