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Diagnosis and implications of cadmium levels in soil of cocoa (Theobroma cacao L) agroforestry systems: academy contribution in the province of Sucumbíos

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Abstract

Cadmium [Cd] is a naturally occurring heavy metal found in small amounts in the Earth's crust. However, human activities such as improper agricultural practices, the application of phosphate fertilizers, monoculture, and excessive tillage; combined with artisanal and industrial mining activities that release Cd during extraction, have increased its concentration in Amazonian soils, turning it into an environmental and public health issue. In the province of Sucumbíos, agroforestry systems for cacao cultivation are a common agricultural practice, and they are not exempt from this reality. The presence of this harmful metal poses an invisible threat to health. The diagnosis and implications of Cd levels in cacao agroforestry soils are part of the project «Reactivation of rural economies through sustainable agriculture in the coffee and cacao value chains in the province of Sucumbíos», which is funded by the Italian-Ecuadorian Sustainable Development Fund, and implemented by the prefecture of Sucumbíos, (ISTEC), and the Scalabrinian Mission. ISTEC soil diagnostics are being conducted as a tool for sustainable agricultural management in the cantons of Lago Agrio, Shushufindi, Cuyabeno, and Putumayo. Physical and chemical analyses are being carried out to determine soil texture, soil organic matter, pH, nitrogen, phosphorus, potassium, calcium, magnesium, iron, zinc, aluminum, Cd and lead, and to infer from these results which properties are related to Cd fixation in these soils. Solutions based on the application of various agroecological amendments will be proposed, tailored to the soil quality in the region. The research involves creating georeferenced maps of areas with the highest Cd concentrations and their possible contamination sources. In addition, surveys are being conducted to assess the social, agricultural, and economic components to determine the multidimensional poverty index of these rural communities. The study will also assess the availability of Cd in the soils of the agroecosystems, as well as the bioaccumulation of this metal in various parts of *Theobroma cacao L.* plants (foliage and beans). As a result, the translocation factor of the Cd transfer rate between soil and fruit in cacao crops will be determined.

Keywords: Amazon, Metal pollution, Amendments, Multidimensional poverty, Translocation.