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Changes in soil carbon content in a chronosequence of transformation from cocoa to pastureland in Southeast Mexico

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Statement of the Problem: The cocoa agroforestry system (CAS) is one of the most important in the state of Tabasco, Mexico. The CAS can store quantities of carbon (C), even higher than some natural forests. Under humid tropics conditions, the size of the soil organic matter (SOM) stores is small and rapidly degrades, so that soil fertility can be quickly depleted making the agroecosystem highly dependent on the supply of fertilizers.

Objectives: The objective of this research was to measure the concentration of soil organic carbon (SOC) and other variables indicating soil fertility, in a chronosequence of pastures that were established on cocoa plantations.

Methodology & Theoretical Orientation: The research was carried out at Jalpa de Méndez, Tabasco, Mexico. Sites that were previously CAS were selected and that currently record a change in land use. With the years of change reported by farmers, the following intervals were established: 1-5 years (PZ 1-5), 6-10 years (PZ 6-10) and 11-20 years (PZ 11-20). At each site samples were taken at three depths (0-10 cm, 10-20 cm and 20-30 cm).

Results: The results indicate that during the first years, the land use changed (PZ 1-5) given a slight decrease in the levels of SOC. Although these increase in the pastures of 6-10 years (PZ 6-10), inclusive above the levels recorded in CAS 20-35. However, this increase is temporary, since it is observed that these storage levels decrease in pastures 11-20 years (PZ 11-20). In the long term, the change of land use from CAS to pasture reduces the SOC stores and some chemical and physical properties. In the first years of the change the reduction of the SOC content is reflected in the young pastures (PZ 1-5). In older pastures (PZ 11-20) the chemical and physical properties declined and the content of the SOC decreases to level below CAS 20-35.

Table 1. Comparison of the levels of SOC and some chemical properties of a chronosequence of change from cocoa agroforestry systems to pastureland.

Treatment	SOC	SOM	N	P	CIC	C/N
	(%)			(mg kg^{-1})	Cmol^{+} kg^{-1}	
PZ 1-5	1.39b[§]	3.27	0.14	394	23.7ab	9.6
PZ 6-10	1.90a	3.33	0.16	324	27.0ab	11.6
PZ 11-20	1.40b	2.37	0.15	441	21.0b	9.3
CAS 20-30	1.61ab	2.83	0.16	511	27.3a	9.9
CV	16.2	35.8	12.60	20.14	11.9	24.2
Pr>F	0.0008	0.85	0.59	0.14	0.11	0.72

§ Different letters indicate statistically significant differences (P<0.05).
C/N= carbon/nitrogen
CV= Coefficient of variation.

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Biography

Eduardo Valdés Velarde is a Professor of Ecology in the Department of Plant Science of Chapingo Autonomous University in Mexico since 2007. He is currently the Director of the Agroforestry Center for Sustainable Development at the same university. He has been a Teacher of high school, undergraduate and graduate students since 1997, lecturing more than 25 subjects. He has been the Director and thesis Adviser for more than 25 undergraduate and graduate students. He has given numerous lectures and courses-workshops in several universities in Mexico and Ecuador. He has been responsible for several research, cultural diffusion, service and technology transfer projects. His main lines of research focuses on the study of ecosystem services in mangroves, cacao and coffee plantations.

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