# **B10 - The Distribution of Soil Organic Carbon and Its Relevance for Soil Water Content in Oil Palm Plantations**

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Introduction

Economic value of oil palm has been causative factor of oil palm plantation development rapidly in some regions of Indonesia. Jambi Province is one of targeted areas for oil palm plantation development. Area of oil palm plantation in Jambi increase continuously. In 2003 it is 302,152 ha and in 2013 increase up to 108,71% or 630,614 ha (Ditjenbun, 2012). Expansion of oil palm plantation is assumed to be responsible for degradation of hydrological function, but not enough comprehensive data to support this statement. Soil water content (SWC) is related to soil organic carbon (SOC). The objectives of this research were (1) to identify distribution of SOC and SWC and (2) to evaluate their relation on several soil depths under different oil palm age-gradient.



### Site Study:

The research have done at Bungku Village, Batanghari District, Jambi Province. Points of soil sampling have got by overlay soil, slope, and land cover maps and based on result of preliminary survey.

# Soil Sampling



# Table 1. Distribution of SBD and SOC under Oil Palm Plantations

Age-Gradient of Oil Palm	0-30 cm		<b>31-60 cm</b>		61-90 cm	
	SBD (g cm <sup>-3</sup> )	SOC (%)	SBD (g cm <sup>-3</sup> )	SOC (%)	SBD (g cm <sup>-3</sup> )	SOC (%)
0 Year	1.43	1.60	1.45	0.90	1.51	0.67
1 Year	1.22	1.40	1.31	0.93	1.37	0.61
5 Years	1.12	0.88	1.19	0.59	1.39	0.29
7 Years	1.44	1.17	1.49	0.64	1.42	0.54
10 Years	1.27	0.90	1.31	0.56	1.43	0.45
16 Years	1.22	1.32	1.28	0.85	1.59	0.66

## Table 2. The Regression Equation of SOC and Soil Water



Disturbed soil sample = to get Data of SOC and Soil Texture

Undisturbed soil sample = to get Data of SBD and SWC on several pF

#### **Result and Discussion**

The smallholder oil palm farmers at Bungku Village managed their plantation without proper technology and oil palm were grown mostly unweeded. The result indicated that soil under different oil palm-age gradient is compact. Soil bulk density (SBD) 1.12-1.59 g cm<sup>-3</sup> and soil organic carbon (SOC) is very low-low or 0.29-1.60% (Table 1). Low SOC was responsible for low soil water availability under oil palm plantation. Meanwhile, relation of SOC and soil water content (field capacity, permanent wilting point, and available water) under different age-gradient of oil palm plantation was not always linear (Table 2). The difference of water consumptive of several age-gradient of oil palm plantation and other factors were presumed to have influence on soil water content under oil palm plantation simultaneously.

#### **Availability under oil palm plantation**

<b>Age-Gradient</b>	Soil Depth	Equation of Regression and R <sup>2</sup>
0 Year	0-30 cm 31-60 cm 61-90 cm	Y = 3.99x - 0.26; R <sup>2</sup> = 0.41 Y = 0.61x + 10.11; R <sup>2</sup> = 0.04 Y = 14.50x + 0.47; R <sup>2</sup> = 0.79
1 Year	0-30 cm 31-60 cm 61-90 cm	Y = -0.34x + 7.94; R <sup>2</sup> = 0.13 Y = 0.75x + 7.27; R <sup>2</sup> = 0.97 Y = 0.21x + 8.85; R <sup>2</sup> = 0.01
5 Years	0-30 cm 31-60 cm 61-90 cm	Y = -4.12x + 12.24; R <sup>2</sup> = 0.99 Y = 28.44x - 8.15; R <sup>2</sup> = 0.35 Y = 9.19x + 5.27; R <sup>2</sup> = 0.99
7 Years	0-30 cm 31-60 cm 61-90 cm	Y = 9.45x + 0.84; R <sup>2</sup> = 0.99 Y = 1.39x + 7.46; R <sup>2</sup> = 0.06 Y = 6.81x + 2.63; R <sup>2</sup> = 0.87
10 Years	0-30 cm 31-60 cm 61-90 cm	Y = -8.19x + 18.13; R <sup>2</sup> = 0.22 Y = -27.64x + 25.22; R <sup>2</sup> = 0.87 Y = -5.06x + 9.63; R <sup>2</sup> = 0.31
16 Years	0-30 cm 31-60 cm 61-90 cm	Y = 0.13x + 13.96; R <sup>2</sup> = 0.001 Y = 21.32x - 8.42; R <sup>2</sup> = 0.94 Y = -58.93x + 49.75; R <sup>2</sup> = 0.66

# **Conclusion and Recommendation**

Relation of soil depth and SOC under different age-gradient of oil palm plantation was linear. Meanwhile, relation of SOC and soil water content under different age-gradient of oil palm plantation was not always linear. Needed more comprehensive research on hydrology function of soil under different age-gradient of oil palm plantation, determinant

factors, and autocorrelation of determinant factors.

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