Soil Microbial Biomass Carbon from the First Year of the Application of No-Tillage and Mulching on Sugarcane Plantation

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INTRODUCTION

Soil microbial biomass carbon (SMBC) is one of the most important soil biological properties. It regulates many critical processes in ecosystems such as carbon cycle of the terrestrial ecosystem. Carbon is a main component of organic matter and microbial cell. Soil which has a variety of soil microorganisms generally indicate that such soil have a good in physical and chemical properties. Sugarcane is a long duration, nutrient exhaustive crop, and has been found to meet its nutrient requirement through microbial mediation. Soils rich in organic carbon content favour the activity of microbes leading to mineralization and availability of nutrients to crops. This research aimed to study the effect no-till (reduce tillage) and bagasse mulch on the SMBC in sugarcane plantation.

MATERIAL AND METHODS

The study site was located in a sugarcane plantation of Gunung Madu Plantation, Lampung province, Indonesia. This research was designed as split plots in randomized block design (RBD) with 5 replications.

The main plot was tillage system,
1. **No-tillage (T0)**
2. **intensive tillage (T1)**

Subplot was the application of bagasse mulch,
1. **without bagasse mulch (M0)**
2. **with bagasse mulch with dosage of 80 Mg ha^{-1} (M1).**

All plot were applied with urea 300 kg ha-1, TSP 200 kg ha^{-1}, MOP 300 kg ha-1, and the application of mix bagasse, blotong (filter cake), and ash (BBA) fresh (5:3:1) 80 Mg ha^{-1}.

Soil were sampled on 27 June 2010, 20 September 2010 and 21 January 2011.

SMBC was measured by a soil microorganisms fumigation-incubation method (Jenkinson and Powlson 1976). Organic carbon, nitrogen total, pH, temperature, and soil moisture were analyzed. Data were analyzed by ANOVA and LSD at level of 5%

RESULTS AND DISCUSSION

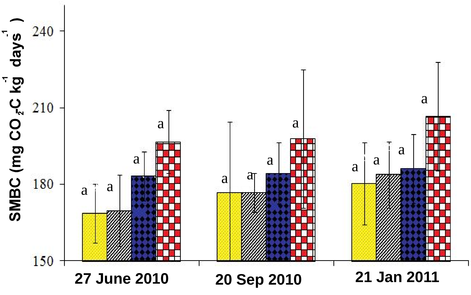


Fig 1. SMBC content in soil before and after application of No-till and bagasse mulch. ■ = Intensive-tillage and without mulch (T1M0), ■ = Intensive-tillage and with mulch (T1M1), ■ = No-tillage and without mulch (T0M0), and ■ = No-tillage and with mulch (T0M1).

– Application of bagasse mulch and no-tillage was not give significantly different by statistical analysis yet, however there was trend to increase of SMBC on the plot of no-tillage and with bagasse mulch

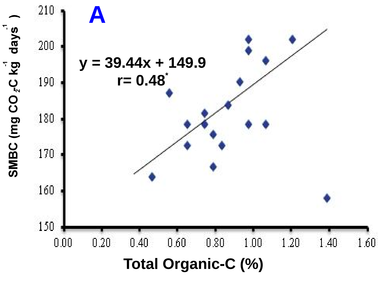
– SMBC in No-tillage and mulching plot almost 50% higher than intensive tillage and without mulching plot

– There was also no interaction between tillage system and bagasse mulching on the SMBC.

– There was no significantly different among treatment on total-C, Total-N, soil pH, soil moisture, and soil temperature.
– Although there was not significantly different on some of soil chemical properties such as organic carbon, total N, soil temperature, soil moisture and pH, we expected the soil fertility will be improved. In present study, it was not enable enough to accumulated soil organic matter (SOM) on experimental plot, so the effect of tillage system was not be seen. Besides of that, the high C/N ratio of bagasse mulch cause the mulch have not been decomposed.

Table 1. Total organic carbon. Total nitrogen, pH, soil moisture and soil temperature on the plot during sampling time

Treatment	Organic-C (%)		Total-N (%)		pH (H_2O)		Soil Moisture (%)		Soil temperature (°C)	
	20 Sep 2010	21 Jan 2011	20 Sep 2010	21 Jan 2011	20 Sep 2010	21 Jan 2011	20 Sep 2010	21 Jan 2011	20 Sep 2010	21 Jan 2011
T_1M_0	0.72	0.95	0.09	0.10	5.82	5.53	18.36	17.44	30.62	29.58
T_1M_1	0.78	0.96	0.10	0.10	5.75	5.64	18.72	19.00	29.96	28.84
T_0M_0	0.86	1.03	0.12	0.10	5.93	5.59	19.32	18.36	29.80	29.34
T_0M_1	1.09	1.06	0.16	0.12	5.60	5.51	18.68	21.36	29.58	28.76



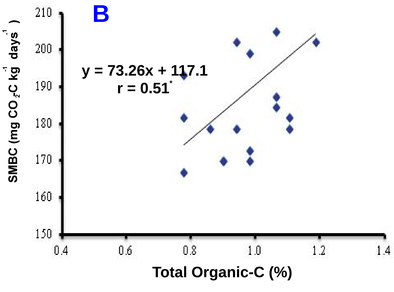


Fig 2. Correlation between SMBC and total organic-C in the plot experiment at 20 September 2010 (A) and 21 January 2011 (B).

The SMBC were higher in soil when total organic C were high, as shown by positive correlation between the SMBC and total organic C. Its relationship meant that organic carbon was very important for the energy for microorganisms growth in this field. So, we have to maintain organic carbon for sustainable soil productivity. The increasing of SMBC was likely to be influenced by no-tillage system and adding organic material to the soil from bagasse

CONCLUSIONS AND SUGGESTION

In the present study, the soil microbial biomass carbon content was not affected by the application on no-tillage system and bagasse until five month of observation. Certainly, further analysis is still needed to make sure that the treatment will increase the soil microbial biomass carbon and soil fertility.