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# PROCEEDINGS of IC-GU 12 UGSAS-GU

## "6TH INTERNATIONAL WORKSHOP ON CROP PRODUCTION AND PRODUCTIVITY UNDER GLOBAL CLIMATE CHANGE"

**Editors :**

**Dr. Afandi**
**Prof. Dr. Ken Hiramatsu**

DECEMBER 3-4, 2018

at FACULTY OF AGRICULTURE, LAMPUNG UNIVERSITY
BANDAR LAMPUNG, INDONESIA

# PROGRAM

Date : December 3rd,2018
Venue : Hall of Faculty of Agriculture, Lampung University (UNILA),
**Plenary Session**

| Start | | Speaker/Chair Person | Title |
|---|---|---|---|
| 8:00 | Registratio | | |
| 8:30 | Session 1 | Chair: Cicih Sugianti & Auliana Afandi | Welcoming and Introductory Session |
| 8:30 | | Prof. Dr. RA Bustomi Rosadi, | Committee Report |
| | | Prof. Dr. Irwan S.Banuwa, Dean of Faculty of Agriculture, | Welcome Address |
| | | Prof. Dr. Hasriadi Mat Akin, Rector of UNILA | Welcome Address |
| | | Prof. Masateru SENGE Dean of UGSAS, GU | Declaration of Opening |
| 9:00 | Photo Session & Welcome Ceremony | | |
| 9:15 | Coffee Break | | |
| 9:30 | Session 2 | Chair: Prof. Chihara E., GU | |
| 9:30 | | Dr. Dwi Hapsoro, Faculty of Agriculture, UNILA | Roles of Plant Tissue Culture on Agricultural Productivity |
| 10:00 | | Assoc. Prof. Teruaki Shimazu , GU | Airflow resistance of insect screen and evaporative cooling for natural ventilated greenhouse in humid temperate/ tropical climate region |
| 10:30 | | Supriyono Loekito PT.GGP | Sustainable agriculture, a strategy to maintain the business sustainability of PT. Great Giant Pineapple under Global Climate Change |
| 11:00 | Q & A | | |
| 11:45 | Lunch break | | |
| 12:45 | Session 3-Paralell at Post Graduate Building, Fac. of Agriculture, Lampung University | | |
| 15:15 | Coffee Break | | |
| 15:35 | Session 4 | Chair: Dr. Tumiar K Manik | |
| 15:35 | | Assis. Prof. Tanaka, T., GU | Applications of Structural Equation Modeling in Crop Yield Variability of the Farmers' Fields |
| 15:55 | | Agustini (Agric.Service, Bandar Lampung City) | Potential of yard Utilization for Supporting the Fulfillment of Food Security in Bandar Lampung City, Indonesia |
| 15:15 | | Assis. Prof. Noda, K., GU | GIS analysis for vulnerability assessment of salt damage on Taro Patch in Palau |
| 16:45 | | Prof. K. Hiramatsu, Vice Dean of UGSAS, GU | Closing |
| 18:30 | | MC: Dr. Afandi UNILA | Banquet , at Bandar Lampung' s mayor house |

**Study Excursion/field trip**, at December 4, to PT.GGP, Central Lampung
Start : 06.30 from Faculty of Agriculture, Lampung University.

## Parallel Session

Venue : Post Graduate Building, Faculty of Agriculture, Lampung University

Room 1

| Start | Speaker/Chair Person | Title |
|---|---|---|
| **12:45** | Chair: Assis. Prof. Noda, | *Influence of Climate Change on Crop Production* |
| 12:45 | T.K.Manik | Predicting Cassava Suitability as Impacted by Climate Change in Indonesia |
| 12:55 | Afandi | Tracking the fate of organic matter residue using soil dispersion ratio under intensive farming in red acid soil of Lampung, Indonesia |
| 13:10 | WARJI | Multi-layered Microcapsules of Biopesticides to Support Sustainable Agriculture |
| 13:20 | Irwan S. Banuwa | Effect of Ridges and Organic Fertilizer on Erosion and Nutrients Loss |
| 13:35 | Q&A | |
| 13:45 | Coffee break | |
| 13:55 | Priyo Cahyono | Effects of Waterlogging on Pineapple Growth and Soil Properties on Red Acid Soils of Lampung, Indonesia |
| 14:10 | Rusdi EVIZAL | Potential Yield of Replanted Trees of Cocoa Clones Introduced in Lampung |
| 14:25 | Dudy Arfian (PT GGP) | Effects of aluminum stress on shoot growth, root growth and nutrient uptake of three pineapple smooth cayenne clone [*Ananas comosus* (L.) Merr.] |
| 14:40 | Didin Wiharso | The effect of long-term cassava cultivation on organic carbon content and soil physical properties in Central Lampung |
| 14:55 | Q & A | |
| 15:15 | Coffee break | |

Room 2

| Start time | Speaker/Chair Person | Title |
|---|---|---|
| **12:45** | Chair: Diding | *Cash Crop productivity and its constraint* |
| 12:45 | Siti Nur Rohmah | Corn Yield and Soil Properties under long term conservation tillage in clayey soil tropical upland of Lampung, Indonesia |
| 13:55 | Lestari Wibowo | The role of refugia in the wetland paddy ecosystem |
| 13:10 | Dwi Oktaria | Soil organic carbon in soil fraction and corn yield under long-term tillage system and nitrogen fertilization |
| 13:20 | Ahmad Tusi | Ventilation Flow Rate and Photosynthesis Prediction based on Water Vapor Balance under Ventilated Greenhouse |
| 13: 35 | Q & A | |
| 13:50 | Coffee break | |
| | | |

| | | |
|---|---|---|
| 14:00 | M. A. Fauzan | Aggregate Stability and Root Biomass Affected by Soil Tillage and Mulching in the Gedung Meneng Soil Planting Green Nut (*Vigna radiata* L.) of the Long Term Experiment |
| 14:15 | Ayu Wulan Septitasari | Application of induced compost of cellulolitic (*aspergillus fumigatus*) and ligninolitic (*geotrichum* sp.) inoculum on the vegetative growth of red chili (*Capsicum annuum* L.) |
| 14:30 | Yogi Irawan | Soil Compaction, Water Content, Bulk Density and Soil Root Biomass Affected by Tillage and Fertilizer on Gedung Meneng Soil under Green Bean Growth |
| 14:45 | Tubagus Hasanuddin | Perceptions of farmers, Effectiveness of Farmers Group, and Diffusion of Innovation of Organic Farming System in Lampung Province |
| 15:00 | Q & A | |
| 15:15 | Coffee break | |

Room 3

| Start time | Speaker/Chair Person | Title |
|---|---|---|
| **12:45** | Chair: Prof. K. Hiramatsu, GU | *Annual Crop productivity and technology for supporting* |
| 12:45 | Novita Desri Wanti | Production and harvested nutrient of cassava (*manihot esculenta l.*) affected by compost and its combination with NPK inorganic fertilizer for the 5$^{th}$ planting period |
| 12:55 | Debby N.A | Simulation of Cavendish Banana Transporation |
| 13:10 | Cicih Sugianti | The application of hot water treatment in mango cv arumanis |
| 13:20 | Maria Viva Rini | The Diversity of Arbuscular Mycorrhiza Fungi at Rhizosphere of Cassava of Thailand Clone Cultivated in Lampung Timur and Tulang Bawang Barat |
| 13:35 | QA | |
| 13:50 | Coffee break | |
| 14:00 | Adinda Kusuma Dewi | Harvested nutrient and production of cassava (*manihot esculenta*) affected by tillage and herbicide in the 4$^{th}$ planting period in Gedung Meneng soil Bandar lampung |
| 14:10 | Nurhidayat | Production and Harvested Nutrients of Sugarcane 1$^{st}$ Ratoon (*Saccharum officinarum* L.) Affected by Organic and Inorganic Fertilizer |
| 14:25 | Agus HARYANTO | Biogas Production From Oil Palm Empty Fruit Bunches through Dry Fermentation Process: Preliminary Results |
| 14:40 | Diding | The Current Status of Authentication of Indonesian Specialty Coffees Using UV-Visible Spectroscopy and Chemometrics |
| 15:55 | Q&A | |
| 15:15 | Coffee break | |

# TABLE OF CONTENT

# Tracking the fate of organic matter residue using soil dispersion ratio under intensive farming in red acid soil of Lampung, Indonesia

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[2]Under graduate student, Faculty of Agriculture, Lampung University

**SUMMARY**

Organic matter or compost which applied to the soil can improve soil physical properties, such as forming microaggregates and increasing soil water holding capacity. However, the effect and the sustainability in the soil depended on the type of organic matter origin and its composition as well as its environment. This study aims to determine the fate of organic material , which is mainly its composition from cowdung using simple tools, soil dispersion ratio (DR). A soil survey was done to the area with different land use and organic matter (compost) application . The area with no compost application (0 t $ha^{-1}$) including in cassava, oil palm, and pineapple (3 locations), while area with banana and guava applied with compost around 50 t $ha^{-1}$ - 100 t $ha^{-1}$ and pineapple with 180 t $ha^{-1}$ . The experiment showed that the soils were generally categorized as moderately to extremely dispersive, except cassava was little dispersive. Clay particles were mostly binded by organic material by the mechanism of cation brigde, and contributied >50% of clay aggregate form, and the highest one was in cassava .

## Introduction

In humid tropical area of Lampung, Indonesia, Red acid soil are dominat, which generally have low nutrient content and soil organic carbon due to intensive leaching and rapid decomposition processes. Organic matter or compost application is mostly recommendation to improve soil fertility in the humid tropics climate.

Tisdall and Nelson (1982) pointed out that the organic binding agent could be (a) transient, mainly polysaccharides, (b), temporary, roots and fungal hyphae, and (c) persistent, resistant aromatic components associated with polyvalent metal cations, and strongly sorbed polymers.

Watanabe (2017) showed that continuous application of cattle manure could stabilize soil organic matter such as in the form of structural alterations, occlusion in soil aggregates, and adsorption to clay minerals, preserved soil organic matter derived from cattle manure.

Due to the fact that clay particle will bind carbon organic component though electrostatic binding or cation bridge ("forming pseudo sand"), a comparison between clay particles and "pseudo sand" particles could be used to evaluate the effect of organic carbon to the soil. This concept which known as dispersion ratio was introduced by Middleton (1930). By comparing comparing dispersed soil partiles with undispersed soil particles, estimation of clay particles which was binded by organic carbon ("pseudo sand or micro aggregate") could be estimated.

This research aimed to evaluate residue of organic matter which mainly consisted of cow manure in pineapple plantation under various amount of application as well as crop rotation.

## Material and Method

This research was carried out in at Terbanggi Besar, Central Lampung, Indonesia. Soil survey was done to the area with different land use and organic matter (compost) application in which the compost was 90% consisted of cow dung. The area which no compost application (0 t $ha^{-1}$) including cassava, oil palm, and pineapple with different age 3,6,9 months,6,9,and 15 months(harvest area), while area with banana and guava applied with compost 50 t $ha^{-1}$ - 100 t $ha^{-1}$ and one pineapple area with 180 t $ha^{-1}$ (code :pineapple 11). Each location was taken 4-5 soil sample with distance 25-50 m, analysed separately as replications. The compost were applied 6-8 months previous to soil sam pling.

The soil dispersion ratio (DR) was defined :

$$\frac{Percent\ silt+clay\ Undispersed}{Percent\ silt+clay\ dispersed} \times 100\ \% \quad (1)$$

The percentage of silt and clay in dispersed form were analysis using texture analysis with the addition of Calgon + $H_2O_2$ + distilled water, while only distilled water was used to get undispersed fraction. Soil texture analysis was carried out using the hydrometer method.

The classification of dispersion ratio was according to Elges (1985) which was as followed : dispersion ratios > 50% (extremely dispersive), 30%- 50% (moderately dispersive), 15% -30%( a little dispersive) and < 15% (non-dispersive).

The calculation of clay fraction that binded by organic carbon could be dvided into two forms (1) binded using "glue mechanism" (2) binded by "cation brigde" mechanism", which were calculated as follows :

Clay-glue mechanism (Cg)

$$Cg = Silt_{undispersed} - silt_{dispersed} \quad (2)$$

Clay cation bidge mechanism (Cc)

$$Cc = Sand_{undispersed} - Sand_{dispersed} \quad (3)$$

So total partices clay that becomes "aggeregate" (Cag)

$$C\ ag = Cg + Cc \quad (4)$$

## Result and Discussions

The basic soil properties which were listed in Table 1 showed that experiments sites were dominated by clay and sand fraction which the soil texture from sandy clay to clay, with clay is dominant.

Table 1.Basic soil properties in the experiment site

| Land use | Texture class* | Clay | Silt | Sand | C-organic |
|---|---|---|---|---|---|
| | | | % | | |
| **Banana-1** | SC | 45.4 | 7.7 | 46.9 | 1.31 |
| **Banana-2** | SCL | 35.3 | 7.5 | 57.2 | 1.06 |
| **Cassava** | C | 53.6 | 7.6 | 38.8 | 1.25 |
| **Guava-1** | SCL | 34.0 | 8.5 | 57.5 | 1.34 |
| **Guava-2** | SC | 38.5 | 8.0 | 53.4 | 0.31 |
| **Oil Palm** | C | 49.2 | 10.1 | 40.7 | 0.88 |
| **Pineapple (3)** | C | 52.2 | 5.9 | 41.8 | 0.57 |
| **Pineapple (6)** | C | 46.1 | 7.5 | 46.4 | 0.57 |
| **Pineapple (9)** | C | 46.9 | 12.7 | 40.4 | 0.77 |
| **Pineapple(11)** | C | 50.1 | 6.5 | 43.4 | 1.57 |
| **Pineapple(15)** | C | 46.4 | 15.5 | 38.1 | 1.08 |

*C: clay; S:sandy; L : loam

The soil carbon organic were low, less than 2%, some even less than 1%, except in pineapple with 180 t/ha compost was 1.57%. With low soil carbon as well as low of kation base in Ultisol soil, the soil aggregation would be very weak

The experiment showed that the soils were generally categorized as moderately to extremely dispersive, except cassava was little dispersive (Fig.1). Although guava and banana had high compost application, the dipersion ratio falled to extremely dispersive, while pineapple with no compost only have moderately dispersive.

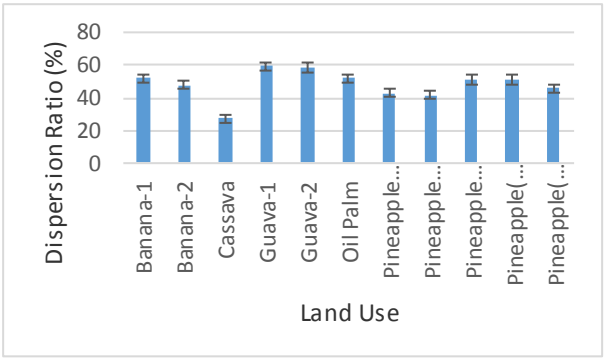


Fig 1. Dispersion ratio from various land use

The lowest of DR was found in cassava land use., which was usually manage with minimum tillage and management. Rasheed (2016) got that the DR value from bare soil with lowest organic matter (1.1%) was only13%. Lipiec et al. (2018) showed that the amount of readily dispersible clay was also effectec by the deformation level of the soil, which was increase in strongly compacted soil and positive correlations with bulk density.

High dispersion showed that there is binding between soil particles with the binding agency, and the binding are not strong. To see the mechanism of "glue" or "cation bridge" mechanism, the equation (2) and (3) were used to calculate from each contribution. The resultas were shown in Table 2.

Table 2 showed that clay particles were mostly binded by organic material by the mechanism of cation brigde, and contribution were above >50%, and the highest one was in cassava land use with 88% value

Table 2. Percentage of clay in silt and sand fraction

| Land use | Cc | Cg | Cag | Cc/Cag | Cg/Cag |
|---|---|---|---|---|---|
| | | | % | | |
| **Banana(1)** | 22 | 20 | 41 | 52 | 48 |
| **Banana(2)** | 22 | 10 | 32 | 70 | 30 |
| **Cassava** | 44 | 6 | 50 | 88 | 12 |
| **Guava(1)** | 19 | 16 | 36 | 54 | 46 |
| **Guava(2)** | 20 | 12 | 32 | 63 | 37 |
| **Oilpalm** | 28 | 17 | 46 | 62 | 38 |
| **Pineapple(3)** | 33 | 16 | 49 | 67 | 33 |
| **Pineapple(6)** | 31 | 11 | 43 | 73 | 27 |
| **Pineapple(9)** | 29 | 14 | 43 | 69 | 31 |
| **Pineapple(11)** | 28 | 21 | 48 | 57 | 43 |
| **Pineapple(15)** | 33 | 12 | 45 | 74 | 26 |

However, the dispersion ratio (Fig.1) showed that the most of soils were categorized as moderately to extremely dispersive that "the bridging cation" were not enough or low to make strong aggregation between soil organic carbon and clay particles. The low cation bases in Ultisol probably the main cause that the micro aggregate built was not strong enough. Baohua and Doner (1993) stated that in the absence of polyvalent cations, negatively charged such as humic acid, may not contribute to stable soil aggregation**.** The effect of exchangeable cation to clay dispersion, such as Na, Fe, OC, Mg, and and Al, as well as Mg, were also shown by .Igwe et al. (2006).

The "glue mechanism" which form "silt undiepersed fraction" contribute significantly in high compost application, such as in banana, pineapple (11) and guava

## Conclusion

The soil were dominately by clay fraction, however , the DR was moderately to extremely dispersive . The binding mechanism were mainly in sand fraction, using cation bridge mechanism, however, it is not strong enogh due the low of soil organic carbon as well as polyvalent cation in red acid soil. The application of high compost with dominated by cowdung material only gave "glue binding mechanism" which aggregated in silt pool.

## Acknowledgement

The authors thanked to PT. Great Giant Pineapple. Central Lampung. Lampung. Indonesia, for facilitating this research.

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