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BİLSEL
CONGRESS

25-26 MAYIS
2024

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25.05.2024

TÜRKİYE Local Time: 13.30

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Prof. Dr. Firuz Demir YAŞAMIŞ

Maltepe Üniversitesi

BELEDİYELERDE KURUMSAL GELİŞME ZORUNLULUĞU: YÖNTEM VE TEKNİKLER

26.05.2024
TÜRKİYE Local Time: 12:00-14:30

HEAD OF SESSION: Mukaila, Ridwan

SESSION-1 HALL-1

AUTHORS	AFFILIATION	TOPIC TITLE
Lusia Leni Maryani, Hari Kaskoyo, Rahmat Safe'i, Yulia Rahma Fitriana	*University of Lampung, Indonesia*	*ANALYSIS OF FACTORS AFFECTING THE OUTPOURING OF WORKING TIME OF FOREST FARMERS*
Eri Devanda Yuda, Susni Herwanti, Arief Darmawan, Hari Kaskoyo	*University of Lampung, Indonesia*	*IDENTIFICATION OF SAWMILL INDUSTRY IN ABUNG TINGGI DISTRICT, NORTH LAMPUNG REGENCY, LAMPUNG PROVINCE*
Najwa Rizky Sabina, Susni Herwanti, Indra Gumay Febryano, Christine Wulandari	*University of Lampung,*	*CHARACTERISTICS OF CUKU NYI NYI MANGROVE ECOTOURISM VISITORS USING TRAVEL COST METHOD (TCM)*
Rizky Reza Maulana, Yulia Rahma Fitriana, Dian Iswandaru, Arief Darmawan	*University of Lampung,*	*BIRD CONSERVATION STATUS IN THE PROTECTED BLOCKS OF COMMUNITY FOREST AREA IN THE BATUTEGI FOREST MANAGEMENT UNITY*
Yoppie Jordan Saragih Duryat Melya Riniarti, Wahyu Hidayat	*University of Lampung,*	*SOCIAL ECONOMIC CONDITION AND DEPARTEMEN OF DESARM OF THE CONSERVATION OF THE NATURAL FOREST OF RAYA WAN ABDUL RACHMAN, PESAWARAN, PROVINCY OF LAMPUNG*
Rafli Indra Ghozali Duryat Subki Tri Maryono Rodian	*University of Lampung,*	*THE IMPACT OF INVASIVE ALIEN SPECIES Spathodea campanulata ON NATIVE SPECIES IN BUKIT BARISAN SELATAN NATIONAL PARK, SUMATRA, INDONESIA*
Elisa Purnomo Sari Duryat Rommy Qurniati Robithotul Huda	*University of Lampung,*	*COMPARİSON OF SOLİD AND LİQUİD ORGANİC FERTİLİZER UTİLİZATİON ON BULK DENSİTY AND SOİL INFİLTRATİON CAPACİTY MEASUREMENT AT SUMBER MAKMUR FARMERS GROUP, KPH BATUTEGİ UPTD LAMPUNG PROVİNCE.*
Agilang Ananda Purwayuda Duryat Tri Maryono Wahyu Hidayat Rodiani	*University of Lampung,*	*GARDEN MANAGEMENT AROUND THE GREAT FOREST PARK AREA WAN ABDUL RACHMAN LAMPUNG PROVINCE.*
Mukaila Ridwan, Abugu Chukwudalu Mariarosa Owologba, Elona Orowo Oraefo, Peace Onyinye	*University of Nigeria,*	*ASSESSMENT OF SUSTAINABLE AGRICULTURAL PRACTICES ADOPTION AMONG SMALLHOLDER CASSAVA FARMERS IN ENUGU STATE, NIGERIA*
Sabrina Ramadhanti Agus Setiawan Gunardi Djoko Winarno Dian Iswandaru	*University of Lampung,*	*IDENTİFİCATİON OF NATURAL TOURİST ATTRACTİON OBJECTS WİTH PUSH AND PULL FACTORS AS THE ROLE OF MANAGERS İN THE PAHAWANG ISLAND TOURİST VİLLAGE*
Rodiani Duryat Tri Maryono	*University of Lampung,*	*ACUT TOXICITY STUDI OF THE LEAF AND FRUIT EXTRACT OF AVICENIA MARINA (FORSSK.) ON WISTAR WHITE MALE MICE*

COMPARISON OF THE USE OF SOLID AND LIQUID ORGANIC FERTILIZERS IN MEASUREMENT OF BULK DENSITY AND SOIL INFILTRATION CAPACITY IN GAPOKTAN SUMBER MAKMUR UPTD KPH BATUTEGI, LAMPUNG PROVINCE

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ABSTRACT

Coffee agroforestry is an agricultural system that combines coffee plants with trees or other plants, which is considered to increase land productivity and sustainability. However, soil conditions in agroforestry vary, affecting plant growth and crop yields. Bulk density and soil infiltration capacity are important parameters in evaluating soil conditions. Bulk density influences porosity and the ability of plant roots to penetrate the soil, while infiltration capacity influences water availability for plants and erosion control. This research aims to evaluate the effect of solid organic fertilizer (POP) and liquid organic fertilizer (POC) on bulk density and soil infiltration capacity in two types of coffee agroforestry land, namely fertile land and critical land. The research was conducted at Gapoktan Sumber Makmur KPH Batutegi, Lampung Province, on coffee agroforestry land with two types of soil. Two types of organic fertilizer are applied at certain doses to coffee plants. Bulk density and soil infiltration rate were measured before and after treatment. Before treatment, bulk density in fertile land was lower than in critical land. However, after treatment, changes occurred. On critical land, POC produces a significant reduction in bulk density, while on fertile land, POP produces a significant reduction. Soil infiltration rates have also changed, where POC is more effective on critical land and POP is more effective on fertile land. Treatment with POP or POC affects the bulk density and infiltration rate of the soil, depending on the initial soil conditions. The choice of organic fertilizer type must be adjusted to the type and condition of the soil to increase the productivity and sustainability of coffee agroforestry land.

Keyword: Solid organic fertilizer, liquid organic fertilizer, bulk density, soil infiltration capacity.

INTRODUCTION

Coffee agroforestry is an agricultural system that combines coffee plants with trees or other crops (Sales et al., 2013). This system is known to enhance land productivity and sustainability (Brown et al., 2018). However, soil conditions in agroforestry areas vary widely, affecting plant growth and crop yields (Bajdoliya et al., 2017). Two important parameters in assessing soil conditions are bulk density and soil infiltration capacity. Bulk density is the mass of soil per unit volume, which affects porosity and the ability of plant roots to penetrate the soil. Meanwhile, infiltration capacity is the soil's ability to absorb water, which influences water availability for plants and erosion control.

Fertile soil is able to support plant growth well, provide sufficient nutrients, and maintain a stable soil structure. On the other hand, critical soil tends to be of poor quality, with a structure that is easily eroded, low organic matter content, and low infiltration capacity. This condition can significantly affect plant productivity. Bulk density (soil weight) and soil infiltration capacity are two important parameters that reflect the physical quality of the soil. High bulk density indicates dense soil and little pore space, which can inhibit root growth and the movement of water and air in the soil. Low infiltration capacity indicates poor soil ability to absorb water, which can cause erosion and nutrient loss.

This research was carried out on coffee agroforestry land in Gapoktan Sumber Makmur KPH Batutegi, with a focus on two types of land, namely fertile land and critical land. Fertile land is land with closed canopy cover and has received organic fertilizer applications for the last three years, while critical land is land with open canopy cover which has only been managed using chemical fertilizers and never used organic fertilizers. Organic fertilizer has an important role in improving soil structure and increasing organic matter content, which in turn can increase bulk density and soil infiltration capacity.

In this research, 4 kg of solid organic fertilizer was applied per plant and 200 ml of liquid organic fertilizer per plant. The aim of this research is to measure and compare the values of bulk density and soil infiltration capacity before and after fertilizer application, as well as to determine the most effective type of fertilizer for each type of land.

By understanding the effect of giving organic fertilizer on soil quality on fertile and critical land, it is hoped that the results of this research can provide appropriate recommendations for farmers in land management. Improving soil quality will not only increase the productivity of coffee plants, but will also contribute to environmental sustainability and food security in the area.

METHODOLOGY

Time and Location of Research

This research was conducted from November 2023 to February 2024 at the UPTD KPH Batutegi, Lampung Province, specifically at the Sumber Makmur farmer group association which was fostered by the Indonesian Rehabilitation Nature Initiation Foundation (YIARI). A map of the research location can be seen in Figure 1.

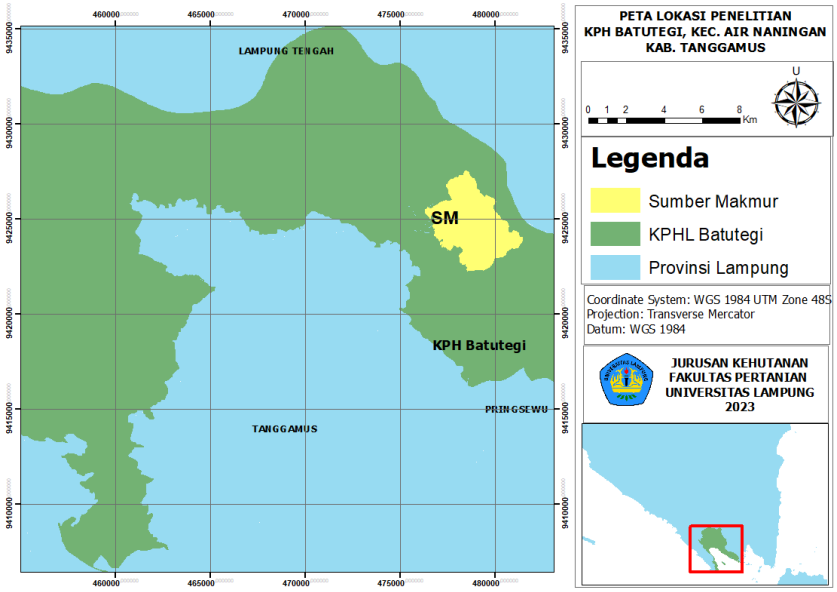

Figure 24. Location Map

Research Tools and Objects

The tools used in this research included sample rings, plastic sample bags, soil shovels/scoops, knives, and cameras. The research object was coffee agroforestry land in Gapoktan Sumber Makmur, with soil samples taken from two types of fertilization treatment, namely soil given solid organic fertilizer and soil given liquid organic fertilizer.

Experimental design

This research adopted an experimental approach to evaluate the effectiveness of solid organic fertilizer (POP) and liquid organic fertilizer (POC) in an agroforestry system with two types of soil, namely fertile and critical soil. In this experiment, the treatment doses used were as follows: for Land I, P1 was the control without fertilizer, P2 was the application of 4 kg POP per plant, and P3 was the application of 200 ml POC per plant. Meanwhile, for Land II, C1 is the control without fertilizer, C2 is the application of 4 kg POP per plant, and C3 is the application of 200 ml POC per plant. The treatment design in this experiment is presented in Table 1.

Table 1. Treatment Design in Randomized Group Design (RGD)

Type of Land	Control Plot	POP Plot	POC Plot
Land I = Open Agroforestry Land	0 kg/plant	4 kg/plant	200 ml/plant
Land II = Closed Agroforestry Land	0 kg/plant	4 kg/plant	200 ml/plant

Data Type

The data used in this research includes primary data consisting of soil physical properties, with variables including soil infiltration capacity and bulk density.

Experimental Implementation

• Laying of experimental plots

Experimental plots were selected uniformly based on the age of the plants and the varieties planted. The experimental plots came from two coffee farmers who had different land covers and fertilizer use histories. Land I is an agroforestry land with closed canopy cover and has applied organic fertilizer, while Land II is agroforestry land with open canopy cover and has never used organic fertilizer.

• Initial Parameter Measurement (Before)

1. Measurement of soil fertility

Soil fertility is measured by taking whole soil samples which will be tested for their physical properties. All soil samples were taken from areas that had not received any treatment. Intact soil samples refer to soil taken in its entirety and represent conditions in the field, including soil structure, moisture and porosity (Agricultural Research and Development Agency, Ministry of Agriculture, 2014). The process of taking whole soil samples is carried out by cleaning the surface of the soil and placing the sample ring on top, then pressing it using the auxiliary ring so that all parts of the sample ring enter the soil. Next, the soil is excavated to remove the sample ring completely and level any excess soil that may be above and below the sample ring (Henrianto et al., 2019).

2. Parameter measurement

The parameters tested were soil infiltration rate and bulk density. Soil infiltration rate is the soil's ability to absorb water within a certain period of time, which influences groundwater formation. Factors such as rain duration, vegetation cover, type and intensity of rain, and previous soil moisture influence the infiltration

capacity of the soil. Optimal infiltration is important for preventing erosion, increasing soil water retention, and supporting healthy plant growth.

Bulk density is the ratio between dry soil weight and total soil volume, including the volume of soil pores. Bulk density measurements involve taking a soil sample from a profile using a sample ring, followed by drying and measuring the weight of the sample to calculate the bulk density. The classification of soil physical property parameters refers to the soil fertility criteria established by the Agricultural Research and Development Agency of the Ministry of Agriculture (2014), which are presented in Table 2.

Table 2. Criteria for Soil Physical Properties

Parameter	Grade					
Soil infiltration rate (cm/hour)	Very slow <0.1	Slow 0.1-0.5	Its slow 0.5-2.0	Currently 0.2-6.0	Medium fast 0.6-12.5	Fast 12.5-25.0	Very fast >25.0
Bulk density	Light <0.9	Currently 0.9-1.2	Weight 1.2-1.4	Very weight 1.4			

Treatment

The treatment given in this research was solid organic fertilizer (POP) and liquid organic fertilizer (POC) which were prepared through a fermentation process. Making POP involves ingredients such as goat dung, gamal leaves, banana stems, EM-4, brown sugar or molasses, and green grass. Meanwhile, making POC uses ingredients such as goat urine, rice field snails, chicken egg shells, fish stomach contents, vegetable scraps, chicken intestines, EM-4, brown sugar, gamal leaves, banana stems and fermipan.

After the fermentation process is complete, the fertilizer can be used on plants according to the dosage determined in the experimental design. The application of solid organic fertilizer is done by making a fertilizer hole around the plant and inserting the appropriate dose of solid organic fertilizer into the hole. Meanwhile, the application of liquid organic fertilizer is done by dissolving the specified dose in 1 liter of water, then pouring it on the bottom of the stem close to the plant roots.

Final Parameter Measurement (After)

The final parameter measurement process is carried out using steps similar to the initial parameter measurements. The difference at this stage lies in measuring the soil and coffee plants that have received

treatment. Thus, after an observation period of 10 weeks, a comparison of the bulk density and infiltration capacity values was carried out before and after treatment.

Data analysis

Data analysis was carried out through a comparative descriptive approach, where comparisons were made between the use of POP and POC to determine which fertilizer was more effective. This is evaluated based on the results of sampling at the initial and final stages of the experiment.

RESULT AND DISCUSSION

1. Bulk Density

The results of calculating bulk density values on the fertile and critical land of Gapoktan Sumber Makmur are presented in table 3 below.

Table 3. Bulk density of soil

Land Type	Bulk Density	Categori
Critical Land		
control plot	1,175 g.cm^3	Medium
After POC	1,038 g.cm^3	Medium
After POP	1,098 g.cm^3	Medium
Fertile Land		
control plot	1,170 g.cm^3	Medium
After POC	1,083 g.cm^3	Medium
After POP	1,016 g.cm^3	Medium

The results of soil bulk density measurements show differences between fertile land and critical land before treatment. The bulk density on fertile land is lower (1.170 g/cm³) compared to critical land (1.175 g/cm³), indicating that there is a larger total pore space on fertile land. Bulk density is an indicator of soil density that describes how tightly the soil particles are arranged. After treatment and observation for 10 weeks, changes occurred. On critical land, plots given liquid organic fertilizer (POC) showed a more significant reduction in bulk density compared to plots given solid organic fertilizer (POP), whereas on fertile land, the results were the opposite. All bulk density values fall into the "medium" category, which indicates good soil conditions for plant growth because it provides sufficient pore space for water and air.

However, after treatment and observation for 10 weeks, changes occurred. On critical land, plots that received liquid organic fertilizer (POC) showed a more significant reduction in bulk density compared to plots that received solid organic fertilizer (POP), with bulk density reaching 1.038 g/cm³ for POC and 1.098 g/cm³ for

POP. On the other hand, on fertile land, the results were the opposite, where plots given solid organic fertilizer (POP) showed a more significant decrease compared to plots given liquid organic fertilizer (POC), with bulk density reaching 1.016 g/cm³ for POP and 1.083 g/cm³ for POC.

Differences in results from using the same dose and type of fertilizer in different locations can be caused by several factors. First, differences in soil chemical properties, such as pH, nutrient content, and soil texture, can influence the response to fertilizer. Second, site altitude influences local microclimate and environmental conditions, which influence soil processes. The history of soil management also plays a role, as previous fertilizer use influences soil health. Lastly, interactions between fertilizer and soil components influence fertilizer effectiveness, with healthier soil tending to respond better to fertilizer applications.

2. Soil Infiltration Rate

The results of calculating the average value of soil infiltration rate on fertile and critical land of Gapoktan Sumber Makmur are presented in table 4 below.

Table 4. Measurement of average soil infiltration rate

Plot	**Critical Land (cm/m)**	**Fertile Land (cm/m)**
Control	0,81	0,98
POC	0,98	1,05
POP	0,88	1,18

In table 4, the results of measuring the average soil infiltration rate are presented. The results show that before being treated, fertile land had a higher soil infiltration rate than critical land, with a percentage of 0.98 cm/minute for fertile land and 0.81 cm/minute for critical land. However, after treatment, the results on critical land were more suitable for using liquid organic fertilizer (POC) because there was an increase in soil infiltration rate compared to using solid organic fertilizer (POP) with a percentage of 0.98 cm/minute for POC and 0.88 cm/minute for POP . On fertile land the results are actually the opposite, because the increase in soil infiltration rate is more significant by using solid organic fertilizer (POP) compared to using liquid organic fertilizer (POC), with a percentage of 1.18 cm/minute for POP and 1.05 cm/minute for POC .

The difference in land cover on critical land and fertile land is one of the factors in the difference in soil infiltration rate values before treatment, where on critical land the land cover is slightly open, while on fertile land the land cover is quite closed. This is in line with the statement Budianto et al. (2014) that vegetation cover has a large role in determining the infiltration rate. Other factors are soil texture, soil organic matter, soil water content, mass density, particle density, and soil porosity Prakarsa et al. (2021).

The difference in values could also arise because when research on control plots was carried out in the dry season in accordance with the statement Ritawati et al. (2012) the infiltration process was also influenced by natural factors including climate (especially rainfall) as well as differences in height and slope of the land affecting the infiltration rate at each land use.

Furthermore, after being given treatment, the results were that there were significant differences in the use of fertilizer types on each land. The significant difference in increasing the infiltration rate, namely the use of liquid organic fertilizer (POC) on critical land and solid organic fertilizer (POP) on fertile land, is caused by the initial condition of the soil and how each type of fertilizer interacts with the soil. Liquid organic fertilizer is more effective on critical land because of its ability to quickly improve soil structure and increase the activity of microorganisms. On the other hand, solid organic fertilizer is more effective on fertile land because it can provide long-term improvements to already good soil structure and provide nutrients in a sustainable manner.

CONCLUSION

1. Before treatment, the bulk density on fertile land (1,170 g/cm³) was lower than on critical land (1,175 g/cm³). After treatment, critical land is more suitable for using liquid organic fertilizer (POC) with a reduction in bulk density to 1.038 g/cm³. Fertile land is more suitable for using solid organic fertilizer (POP) with a reduction in bulk density to 1.016 g/cm³.

2. Before treatment, fertile land had a higher soil infiltration rate (0.98 cm/minute) compared to critical land (0.81 cm/minute). After treatment, on critical land, liquid organic fertilizer (POC) increased the soil infiltration rate more significantly (0.98 cm/minute) than solid organic fertilizer (POP) (0.88 cm/minute). On fertile land, solid organic fertilizer (POP) provides a greater increase in soil infiltration rate (1.18 cm/minute) compared to liquid organic fertilizer (POC) (1.05 cm/minute).

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