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Improvement Of The Physical Properties Of Rainfed Rice Soil In Sungai Rakyat Village, Panai Tengah Sub-District, Labuhanbatu District By Utilizing Municipal Waste Into Compost

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ABSTRACT

Utilization of organic matter is one very big step in increasing soil fertility, and will determine soil productivity. The role of organic matter does not only play a role in providing plant nutrients, but is far more important in improving the physical, chemical and biological properties of the soil. This is very related that through the application of organic matter efforts can be made to rehabilitate degraded paddy soil. This research aims to provide organic matter to determine and rehabilitate its physical properties, Sungai Rakyat Village, Panai Tengah District, Labuhanbatu Regency. This research was conducted in Sungai Rakyat Village, Panai Tengah District, Labuhanbatu Regency with an altitude of ± 8 meters above sea level. This study used a non-factorial Randomized Block Design (RBD) with doses of organic matter (S) City Garbage Compost treatment, which consisted of 5 (five) levels, namely: Control, 1.5% (42.70 tons/ha), 3% (65.40 tonnes/ha), 4.5% (78.10 tonnes/ha), 6% (104.8 tonnes/ha). Provision of organic fertilizer, namely municipal waste compost as much as 42.70 tonnes/ha to 65.40 tonnes/ha, can improve soil properties in Sungai Rakyat Village, Panai Tengah District, so that the soil organic matter content reaches 3%.

Keywords: Organic Matter, Soil Properties, Paddy Oil, Garbage, Panai Tengah

1. INTRODUCTION

In degraded paddy fields, one of them is indicated because of low organic matter and potassium. Organic matter has an important role in determining the ability of the soil to support plants, so that if soil organic matter levels decrease, the ability of the soil to support plant productivity also decreases (Surya et al, 2017). According to the Agency for Agricultural Research and Development (2006) organic matter is very useful for increasing agricultural production both in quality and quantity, reducing environmental pollution, and improving land quality in a sustainable manner. The productivity of a paddy field besides being determined by the fertility status of the soil is also determined by its management such as fertilization, land management, irrigation systems and organic matter extraction (Syawalet al., 2017). Besides that, another factor that affects the value of bulk density is soil structure, where soil that has a fine structure has a low bulk density value. The deeper into the soil profile, the density of the soil mass increases. This appears to be the result of the low organic matter content and the piling up of tools and compaction caused by the weight of the overlying layer (Yuda et al., 2017).

The role of organic matter is very large in increasing soil fertility, and will determine soil productivity. The role of organic matter does not only play a role in providing plant nutrients, but is far more important in improving the physical, biological and chemical properties of other soils such as soil pH, soil cation and anion exchange capacity, soil buffering capacity and neutralization of toxic elements such as Fe, Al, Mn and other heavy metals (Widodo and Kusuma, 2018). Apart from rice straw compost, there is also municipal waste compost. According to Susandiet al., (2015) municipal waste compost can be made from municipal waste in the form of market waste and household waste that has undergone weathering (composting) with the use of appropriate compost, namely municipal waste compost. The physical properties of the soil can be improved, namely the structure and texture of the soil through the formation of more stable, loose aggregates and good soil aeration and drainage. (Handayani and Wahyuni, 2016) small ones are good for agricultural land because the small bulk density of the organic matter they contain will be greater so that it will cause better aeration in the soil. (Syawal and Rauf, 2017).

2. MATERIALS AND METHODS

This research was conducted in Sungai Rakyat Village, Panai Tengah District, Labuhanbatu Regency with an altitude of ± 11 meters above sea level coordinates 2°31'17.4"N, 100°09'54.4"E, as shown in Figure 1. Soil analysis was carried out at the Physics Laboratory and Soil and Water Conservation and Technology Research Laboratory, Faculty of Agriculture, University of North Sumatra. This research was conducted from August 2022 to December 2022

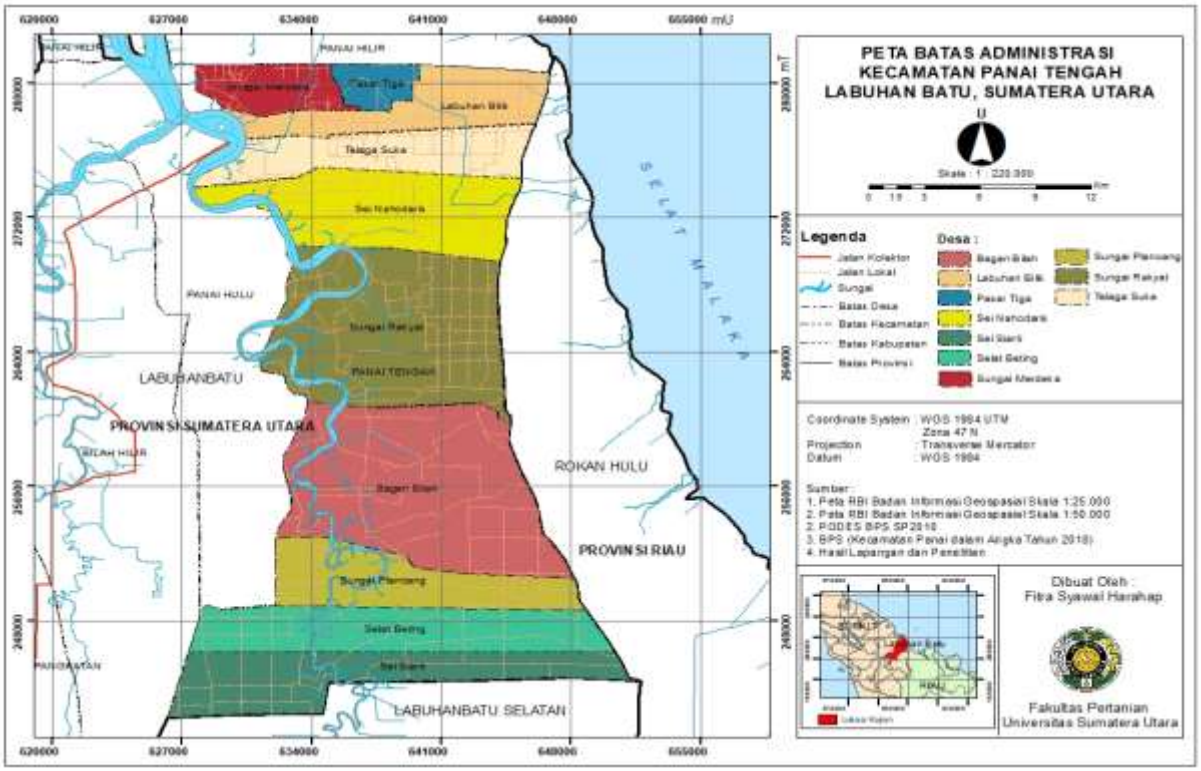

Figure 1. Map of research locations in Sungai Rakyat Village, Panai Tengah District.

The materials in this study were paddy soil in Sungai Rakyat Village, organic fertilizers (municipal waste compost), Urea, SP36 and KCl fertilizers as basic fertilizers, insecticides, fungicides and other materials needed. The tools used in this study were hoes, handtractors. , Gembor soil drill, hammer, raffia, tape measure, scissors, knife, sample hammer, nameplate, handsprayer, camera, stationery

This study used a non-factorial Randomized Block Design (RBD) with doses of organic matter (S) City Garbage Compost, which consisted of 5 (five) levels, namely: S0 = Control, S1 = 1.5% (42.70 tons/ha)), S2 = 3 % (65.40 tons/ha), S3 = 4.5 % (78.10 tons/ha), S4 = 6 % (104.8 tons/ha). Soil samples were taken using a hoe/drill at a depth of 0-20 cm as much as ± 1 kg of soil for each soil sample. From each of these soil samples, the results of coordinate readings were recorded on the GPS (Rauf, A and Harahap, FS, 2019)

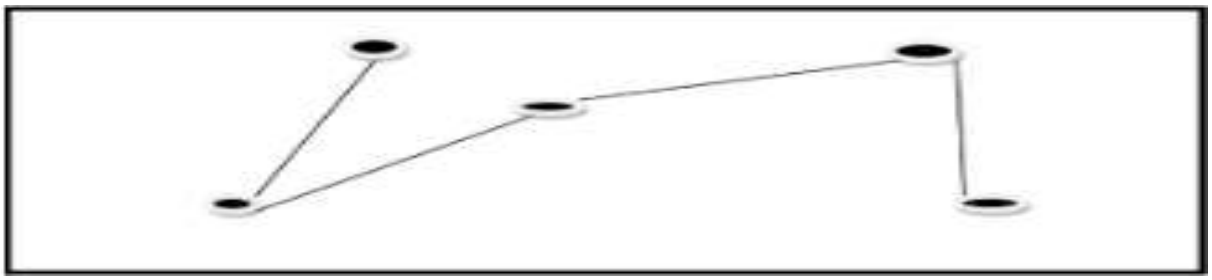

Figure 2. Side point of soil sampling at the study site

Research results by Harahap et al., 2021 based on the nutrient status of the pH content of rainfed lowland rice fields are in the very acid and slightly acidic category, while for C-organic and organic matter are in the low category so as to increase the productivity of rainfed lowland rice fields with soil organic matter

content. The research results were analyzed using variance. If the results of the analysis of variance showed a significant effect, then it was continued with a different test of means using the DMRT test at the 5% level (Sastrosupadi, 2000). The parameters measured were physical properties: Bulk Density (g /cm3), Porosity (%).

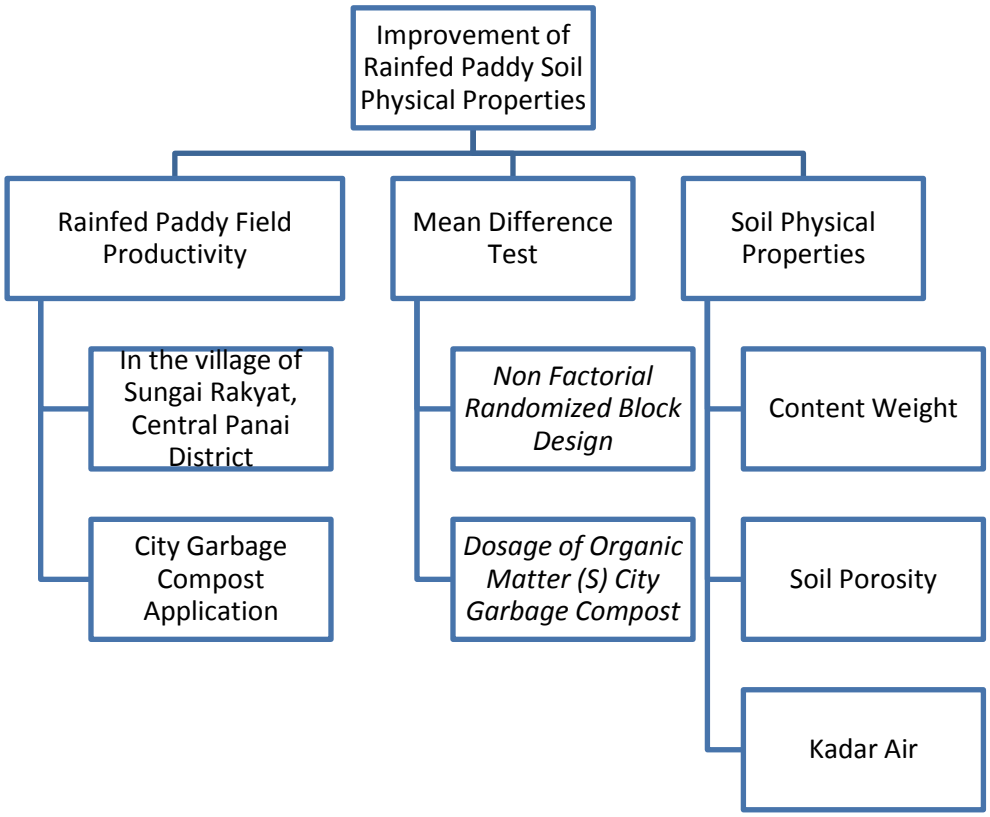

Figure 3. Flowchart of the Research on the Improvement of the Physical Properties of Rainfed Paddy Soil in Sungai Rakyat Village, Panai Tengah District

3. RESULTS AND DISCUSSION

Effect of city waste compost is found on the physical properties of paddy soil.

The effect of applying municipal waste organic matter to paddy rice cultivation on soil physical properties can be seen from the observation parameters which include soil physical properties Bulk density (gr/cm3), Porosity (%) soil.

Table 1. Soil physical properties Bulk density (gr/cm3), Porosity (%), Moisture Content (%) due to the application of organic matter from city waste compost

Treatment	Soil Physical Properties		
	BD (gr/cm^3)	Prositas (%)	Kadar Air (%)
Control	1.14 a	56.56 d	28,73
1,5 %	1.08 b	59.1 c	30,52
3 %	1.06 b	59.82 bc	33,14
4,5 %	1.05 bc	60.51 ab	34,14
6 %	1.03 bc	61.64 a	41,85

Information : Numbers followed by the same letter in the same column indicate which is not significant based on Ducan's multiple range test at 5% level

The results of the analysis of variance on the physical properties data showed that the application of organic matter from municipal waste compost had a significant effect on the physical properties of the soil. The results of the mean difference test in Table 1 on soil physical properties Bulk density (gr/cm3), Porosity (%), using Duncan's multiple range test, are presented in Table 1. The highest bulk density was found in the S0 treatment (Control) while the lowest was in the treatment S4 (6%). The effect of adding municipal waste organic matter on Bulk Density was the best S4 (6%) but not significantly different from treatment S3 (4.5%). This is because the top surface soil layer which is rich in organic matter and loose has a lower bulk density than the bottom layer which is dense with low humus content. According to Al-Shammary et al., (2018), the surface soil is granular, this is due to the relatively high organic matter content.

Granules cause a low density of soil soil and a high total pore. The highest porosity was found in treatment S4 (6%) while the lowest was in treatment S0 (Control). In general, topsoil in mineral soils has a lower bulk density than the soil beneath it. The bulk density value of mineral soils ranges from 1-0.7 gr/cm3, while organic soils generally have a bulk density between 0.1-0.9 grams/cm3 (Rusmini, 2018). The same results were obtained by Roki (2016) in Lasa (2017), explaining that the high bulk density value in candlenut stands was probably because the soil on that land contained low organic matter. On the other hand, soils with high organic matter will have a low bulk density, the range of soil soil density varies quite widely depending on the pore space and soil texture.

Soils with high or large bulk density have a lot of mineral content, but the porosity is low because the higher the bulk value density, the porosity will decrease (Harahap et al., 2020). The effect of adding municipal waste organic matter on the best porosity S4 (6%) was not significantly different from treatment S3 (4.5%). The greater the total porosity value of the soil, the greater the maximum water holding capacity of the soil. The ability of the soil to pass water and air does not always correlate closely with its total pore value, but is more influenced by the percentage of pore size distribution. According to Lapadjati et al (2016) if the pore size distribution of a soil is dominated by large pores (macro pores), then in general the soil has a low ability to store moisture, but this soil has a large ability to pass water and air, this is supported by the statement According to Hardjowigeno (2015), soil with reduced pore space and increased soil weight per unit causes an increase in soil bulk density. Soils with a large weight will find it difficult to transmit water or difficult for plant roots to penetrate, and vice versa in soils with a low bulk density, plant roots develop more easily.

The effect of adding municipal waste organic matter on water content (%) was best S4 (6%) but not significantly different from treatment S3 (4.5%). The highest water content (%) was in treatment S4 (6%), namely 41.85%, while the lowest was in treatment S0 (Control), namely 28.73%. The water content of the soil can be determined in several ways, such as wet and dry, so the range is uncertain. about the water content so that the terms saturated and unsaturated can be interpreted that are fully filled and which show any water content where the

pores are not fully filled. (Zainuddin et al., 2022) Therefore, plants planted in sandy soils generally dry out more easily than clay or clay textured soils. Conditions of excess water or lack of water can interfere with plant growth (Harahap et al., 2021).

4. CONCLUSION

Provision of organic fertilizers as much as 38.70 tons/ha to 77.40 tons/ha can improve soil physical properties, namely water content, bulk density and soil porosity in Sungai Rakyat Village, Panai Tengah District. So that to increase the productivity of paddy fields in Panai Tengah District, fertilizer is recommended organic matter as much as 42.70 tonnes/ha to 65.40 tonnes/ha until the soil organic matter content reaches 3%.

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