Entisol Chemical Properties In The Organic Agriculture System

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abstract

Farming systems based on high input energy materials (fossil materials), such as chemical fertilizers and pesticides, can damage soil properties and will ultimately reduce soil productivity in the future. Alternative agricultural systems using low input energy (LEE) are believed to be able to maintain soil fertility and environmental sustainability while at the same time maintaining or increasing soil productivity. Organic farming systems prioritize the use of organic materials and the recycling of waste. This research reveals how changes have occurred in the physical and chemical properties of soils that have carried out organic farming systems several times. The study uses a method of sampling farmers' land that has been studied to treat organic and non-organic farming systems. Two soil samples were taken from 2 different locations to represent organic soil farming systems and 4 soil samples were taken from 4 different locations to represent non-organic farming systems. Soil sampling was carried out at a depth of 20 cm. The results showed significant differences in the chemical properties of the soil (CEC, pH H2O, available P, available K, total N, carbon content, humic acid and fulfat) between the soil with organic and inorganic agriculture systems that showed better values in the organic farming system

Key word: organic farming, chemical properties of the soil, entisol

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A. INTRODUCTION

Entisol soil is a relatively less profitable land for plant growth, so it needs efforts to increase its productivity through fertilization. The conventional farming system until now has been using chemical fertilizers and pesticides that are receiving higher doses . This increase in the dose causes the accumulation of nutrients derived from the fertilizers/pesticides in the water and groundwater, which translates into environmental contamination. The land itself will also experience saturation and damage due to the influx of high technology. In this context, organic farming systems began to develop that had been practiced for a long time by our ancestors. Some farmers in Lemery, Batangas have done it, while others have not been interested because they do not know the benefits, especially to improve soil properties. After several times doing this culture system, it is necessary to study the changes in chemical properties that occur.

Organic Agriculture System

Increasing the use of artificial fertilizers and pesticides can cause serious environmental problems. As awareness of sustainable agriculture grows, the importance of organic matter utilization in soil nutrient management is increasingly understood. The use of organic matter in the soil is believed to improve the physical, chemical and biological properties of the soil (Engelstad, 1991).

Organic material is not absolutely necessary in plant nutrition, but for efficient plant nutrition, its role should not be negotiable. The contribution of organic matter to plant growth has an effect on the physical, chemical and biological properties of the soil. they have a chemical role in providing N, P and S for plants, a biological role in influencing the activity of microflora and microfauna organisms, and a physical role in influencing soil structure and others. Organic farming or organic farming can be interpreted as a crop production system that is based on biological recycling. Nutrient recycling can be done through plant and livestock waste facilities, as well as other wastes that can improve soil fertility status and structure. Nutrient recycling is a traditional technology that has been around for a long time. Western agricultural experts refer to it as a system that seeks to return all kinds of organic matter to the soil, both in the form of agricultural and livestock residues, which later aims to feed the plants (von Uexkull and Beaton, 1991). Organic agriculture or cultivation system is an alternative solution to limit the possibility of negative impacts caused by chemical cultivation (Sutanto, 1992).

Based on the definition of a low-tech input farming system, there are two objectives to be achieved, namely:

1. Try to optimize the management and use of the productive inputs of the farm's own resources, so that adequate and economically profitable agricultural products are obtained. This approach focuses on crop management such as crop rotation, recycling of agricultural waste, utilization of manure or livestock manure, conservation-based soil management to prevent erosion and nutrient loss, and maintenance and increase of soil productivity.
2. Limit agricultural dependence on off-farm resources such as factory fertilizers and pesticides, reduce production costs as much as possible, avoid contamination of surface and ground water, limit pesticide residues in food, limit all risks faced by farmers and increase agriculture. short and long term benefits .
3. This agricultural system still uses modern technology, such as labeled hybrid seeds, carries out soil and water conservation, and soil management is conservation-based. Limit the use and needs originating from external agriculture, such as industrial fertilizers and pesticides, by developing crop rotation, developing integrated crop and livestock management, recycling agricultural waste and manure to maintain the soil productivity. .

Land of Entisol

In the Philippines, Entisol land is mainly cultivated for rice fields, both technical and rainfed in lowland areas. This soil is loose in consistency, has a low aggregation rate, is sensitive to erosion, and has a low nutrient content. The soil potential derived from volcanic ash is rich in nutrients but not yet available, weathering will be accelerated if there is sufficient organic matter activity as a supplier of organic acids (Tan, 1986).

Organic farming systems prioritize the use of organic materials as one of the requirements in agricultural activities. The use of organic material is expected to improve the physical and chemical properties of Entisol to support better plant growth. It is necessary to carry out research on the changes in soil properties after various organic farming systems to determine the benefits of this system in improving soil properties and ensuring its continued use.

Artificial chemical fertilizers supply certain nutrients in the form of highly concentrated, soluble inorganic compounds. Repeated supply can endanger the flora and fauna of the natural soil, causing an imbalance of nutrients in the soil, and with the usual system of nutrient management, this time can lead to the contamination of water supplies, especially raw waters. underground. Organic fertilizers provide a variety of nutrients, mainly in the form of low-concentration organic compounds that do not dissolve easily. Because it provides a variety of nutrients in low concentrations and does not dissolve easily, organic fertilizer will not cause nutrient imbalances in the soil, it may even improve the nutrient balance. The supply of organic matter can nurture natural soil flora and fauna life, which in turn can improve and maintain soil productivity ..

B. METHOD

This research is a field trial followed by laboratory analysis. The method used is sampling Soil sampling location in Arumahan, Lemery, Batangas province. 2 soil samples were determined to represent soil with organic farming systems and 4 soil samples from non-organic farming systems. Each repeated 3 times.

Entisol soil is taken from the location of organic and non-organic farming systems, Lemery, Batangas (data according to local Department of Agriculture sources) and soil samples from lands that do not carry out organic farming systems. In addition, secondary data on soil conditions (fertilizer history, measurements, weather data, etc.) were collected. The work in the laboratory includes the analysis of the physical and chemical properties of the soil. Soil examples 0-30 cm deep from paddy fields. Soil sampling was carried out at a combination of 5 points per paddy field plot using the zigzag method.

A set of tools for the analysis of physical and chemical properties, as well as chemicals for analysis is prepared as follows: determination of organic matter according to the method developed by Walkey and Black (Prawirowardoyo et al., 1987), content of total N of the soil from the Kjehdal method (Tan, 1996), the content of available P of the soil is the Bray I method (Tan, 1996), the content of K is the available soil (Tan, 1996), the content of humic and fulfat acids (Tan, 1996), cation exchange capacity of the soil with ammonium acetate saturation pH 7.0 (Tan, 1996).

A data analysis was then carried out to determine the differences between organic and non-organic farming systems in the parameters of the physical and chemical characteristics of the soil at the level of 5% myrtle.

C. RESULT AND DISCUSSION

Table 1. Effect of treatment on available P, cation exchange capacity, pH H2O, pH HCl and organic C content

Nope	Treatment	P Available	CCA (I/ 100 grams)	pH H2O	pH HCl	C Organic (%)
1	organic farming 1	8.36b –	25c –	5.52c –	4.83 to	2.94c –
two	organic farming 2	8.39 to	22 d	5.75 e	4.80 to	3.09 to
3	Non-organic agriculture 1	7.22 d	33 ap	6.51f –	4.81 to	2.96b –
4	Non-organic agriculture 2	8.26c –	25c –	5.56 d	4.67b –	2.07f –
5	Non-organic agriculture 3	6.71 e	31 to	5.27d –	4.50c –	2.33d –
6	Non-organic agriculture 4	6.58e –	29b –	5.46b –	4.80 to	2.28 e

Note: Numbers followed by the same letter do not indicate a significant difference from the 95 % level.

1. P available in soil

The results of the statistical analysis with DMRT (Duncan Multiple Range Test) show that there are significant differences between treatments. Organic farming significantly increases the available P in soils. This increase in available P can occur due to the release of P from added organic matter, also due to the indirect effect of organic matter on P that exists in the soil sorption complex. It is known that organic matter reduces the absorption of P by iron oxide and Al and also the colloidal clays present in this soil.

Pelapukan bahan organik menghasilkan asam-asam organik seprti asam humat dan fulfat yang bersifat polielektrolit. Kedua asam ini memegang peranan penting dalam pengikatan Al dan Fe sehingga P menjadi tersedia. Keefektifan pengikatan tersebut dipengaruhi oleh struktur bahan organik yang ditambahkan dan pH medium (Ruseel, 1978). Soepardi (1983) menyatakan bahwa adanya senyawa organik yang cukup memungkinkan terjadinya khelat yaitu senyawa organik yang berikatan dengan kation logam (Fe, Mn, Al). Terbentuknya khelat logam akan mengurangi pengikatan P oleh oksida maupun lempung silikat sehingga P menjadi lebih tersedia.

Hasil analysis menunjukkan bahwa terjadi peningkatan kandungan Karbon tanah, diikuti peningkatan kandungan asam humat dan fulfat yang merupakan hasil dekomposisi bahan organik. Dengan demikian dapat dikemukakan bahwa peningkatan P tersedia pada perlakuan budidaya organik juga diakibatkan pelepasan P dari kompleks jerapan oleh asam humat dan fulfat yang dihasilkan oleh pelapukan bahan organic.

2. Cation exchange capacity of the soil

The results of the soil analysis show that there are significant differences between the treatments. According to the theoretical basis, organic matter contributes to a very large negative charge of the soil through its very high surface area, so the provision of organic matter is expected to increase the cation exchange capacity. But the results of the study show that the cation exchange capacity in soils that are cultivated with organic agriculture is lower than in non-organic ones. It seems that 5 years are not enough for the earth to increase its cation exchange capacity.

3. Soil H2O pH

of the soil H2O pH measurements showed that there were significant differences between the treatments. Soil that is not treated with organic cultivation shows a tendency to lower the pH. The lower pH in inorganic agriculture is due to the use of industrial fertilizers, especially urea, which will increasingly acidify the soil. Organic matter has a great buffering capacity, so if the soil contains enough of these components, the soil pH is relatively stable.

4. Soil KCl pH

The KCl pH shows the amount of hydrogen that dominates the exchange complex and the soil solution. The results of the statistical analysis showed that only 2 treatments from non-organic agriculture showed a real difference, while another 4 (2 from organic agriculture and 2 from non-organic agriculture) did not show a significant difference. This agrees with the earlier statement that 5 years has not been enough to affect the character of the dakhil soil, it is the soil solution that is most affected.

5. Soil C content

Organic farming significantly increases the carbon content of the soil. Carbon is the largest component of organic matter, so giving organic material will increase the carbon content of the soil. This high carbon content in the soil will affect the properties of the soil for the better, physically, chemically and biologically. Carbon is a food source for soil microorganisms , so the presence of this element in the soil will stimulate the activities of microorganisms, thus increasing the process of soil decomposition and also the reactions that require the help of microorganisms. , such as dissolution of P, fixation of N, etc.

Table 2. Effect of treatment on Humic Acid, Fuluric Acid, Total N and available K

	Treatment	Humic acids (%)	Fulfat acid (%)	Total No. (%)	Available (mg/100gr)
1	organic farming 1	0.33 to	0.35 to	0.23 to	1.78b -
two	organic farming 2	0.24 d	0.31b -	0.21 cd	1.17c -
3	Non-organic agriculture 1	0.16f -	0.22 of	0.22b -	2.12 to
4	Non-organic agriculture 2	0.26c -	0.22 of	0.21 cd	0.83d -
5	Non-organic agriculture 3	0.26c -	0.17f -	0.19 e	0.66 e
6	Non-organic agriculture 4	0.17 e	0.25 e	0.17f -	0.60f -

Note: Numbers followed by the same letter do not indicate a significant difference from the 95% level

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6. Humic acid content and soil satisfat

In general, the composition of soil organic matter is dominated by the humin fraction with a very large molecular weight, the humic acid fraction with a moderate molecular weight, and the fulfat fraction with a lower molecular weight. Humic acid is a fraction that dissolves in alakali but does not dissolve in acid or water. Humic acid is capable of interacting with metal ions, mineral oxides and hydroxides. This is because humic acid contains active functional groups such as carboxyl, phenol, carbonyl, hydroxide, alcohol, amino, quinone, and methoxy, in addition to its porous form so that it has a large surface area. This acid has a strong influence on the absorptive capacity of the soil (Stevenson, 1994). The analysis showed that organic cultivation remarkably increased the humic acid content in the soil. This increase affects the water holding capacity (water holding capacity) and also improves the soil structure by adding soil colloids. Folic acid has somewhat similar properties to fulfat, but its molecular weight is lighter and it is soluble in acid.

7. Total soil N content (%)

Nitrogen is the main macronutrient needed by plants. This element is called primary macroelement because it is the most important in the life cycle of plants. The results of the measurement of the total N of the soil show that the lands cultivated with organic agriculture contain more total N, although the increase is not striking. The increase in total N in the soil comes from the mineralization of organic matter added in organic farming, while in non-organic farming systems N is added in the form of nitrogen fertilizers. It turns out that the addition of fertilizer N to the soil does not necessarily have to be followed by an increase in the total N content of the soil. This is because more N is lost carried by crops or by leaching and evaporation.

8. K available in soil

Potassium is also a primary macronutrient for plants. The existence of this element is very important for the self-defense of plants against pests, diseases and droughts. Organic farming systems markedly increase the K content of available soils, although in non-organic farming systems there are locations that indicate higher K availability, but this is likely due to newly cultivated KCl. Organic farming systems allow a better nutritional balance.

D. CONCLUSION

Organic farming systems significantly improve soil chemical properties by increasing available P, total N, available K, carbon content, humic acid, fulfat acid, and maintain soil pH stability.

A deeper study of the organic farming system will be very useful to maintain the sustainability of the soil. It is necessary to study the types and sources of organic materials used in organic farming systems and their effects on the physical and chemical properties of the soil **.**

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