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Soil quality assessment in organic and non organic paddy fields in Susukan, Indonesia

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Abstract

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Paddy is the main food crops in Indonesia. Organic farming system especially paddy, is starting to developed because the decreasing of soil quality with non organic farming system. This study aims to find out the comparison of soil quality of organic and non organic paddy fields with conventional irrigation system in Susukan, Central Java, Indonesia. This research uses descriptive explorative method with survey approach on 10 points of organic paddy field and 2 points of non organic paddy field. Statistical analysis was performed by correlation analysis and Principal Component Analysis (PCA) to determined the indicators affecting soil quality, which are called minimum data set (MDS). Indicators was selected MDS include SOC, total N, C/N ratio, qCO_2, CEC, Eh, available P, EC and permeability. The results showed that there were differences between the SQI of organic and non organic paddy fields, there are 4.2 and 3.9. Both of them are class 3 (medium), but SQI value showed that organic soil is higher than non organic soil.

Keywords: organic; paddy fields; conventional irrigation; soil quality
Abbreviations: SOC – Soil Organic Carbon; BS – Base Saturation; qCO_2 – Soil respiration; Eh – Redox Potential; PCA – Principal Component Analysis; MDS – Minimum Data Set; SQI – Soil Quality Index

Introduction

Agricultural activities by humans try to utilize the resources in excessive damage to environmental conditions, resulting in acceleration of damage to natural resources, soil and water. The sustainability of land resources is affected significantly, as indicated by increasing the input farm business to obtain the same yield target. Agriculture is in line with the development of agriculture with low input technology and efforts toward sustainable agriculture development. It is important to note that the availability of natural resources is limited, so as a manager, people must conserve natural resources to utilize them as well as possible. Budianta et al. (2017) conclude that to make better the life, it is required safety foods for health. Healthy foods are provided by organic farming. Organic farming is a farming system based on biomass recycling and eliminating the using of agrochemical inputs.

Paddy is the main food crops that is cultivated in almost all region of Indonesia. One of the important determinants of paddy production is the availability of soil nutrients and soil conditions. Limiting factors like this need to have related indicators, because for nutrient content and soil quality not only approximately, or in other side must have laboratory analysis. After the results are obtained from analysis, the most appropriate steps of land management can be determined for increase the productivity of plants. Intensive agricultural production can be an important driver for the loss of long term soil quality (Van Leeuwen et al., 2015).

Soil quality is the capacity of soil to perform its function as a component of the ecosystem. Soil quality is observed from several properties of soil, including physical, chemical and biological properties. The assessment of soil quality is performed by assessing some of the most representative indicators of physical, chemical and biological soil that indicating soil conditions. Assessment of soil quality can be used for various purposes related to land management, especially in agriculture. According to Haefele et al. (2014), soil quality has been related for long time with agricultural productivity. Before mechanization and extensive usage of chemical fertilizers, the physical, chemical and biological properties of soil are the main determinants of soil fertility and farmers have some options to improve soil quality and crop production.

Irrigation system determines the quantity of water entering to irrigate the land. Irrigation water contains either dissolved elements of nutrients for plants and also carry weed seeds. Using more water for irrigation increases the amounts of dissolved nutrients and weed seeds that enter the field with it. Usaging less water leads to support smaller amounts of dissolved nutrients into the field. Conventional irrigation system is a construction irrigation system with water regulating doors that water will be drain into the field. So, the water which are given is not consistent every time. As stated by Purba (2011), this method applies if the amount of available water is very limited, while the water demand (especially when processing the soil) is quite a lot. The study aims to compare the soil quality on organic and non organic paddy fields.

Materials and Methods

Field survey

Land analysis was conducted in Susukan, Central Java, Indonesia, precisely at 7°3′57″ – 7°30′00″ South Latitude and 110° 14′54.75″- 110°39′3″ East Longitude on 497 meters above sea level. Conversion of paddy field from non organic to organic has been going on for 8 years. Differences of organic and non organic paddy field are related to fertilization. The fertilizers used on organic paddy field were 6000 kg farm yard manure/ha and 3 liter molasses/ha. While fertilizers used on non organic paddy field were 300 kg urea/ha, 100 kg SP36 (super phospat)/ha, and 50 kg KCl (potassium chloride)/ha (Ministry of Agriculture, 2007).

Land sampling was based on Land Unit Map from overlay between rock distribution map, soil type map, geological map and land use map. Sampling was done at 12 point location, among which 10 points on organic paddy field and 2 other points in non organic paddy field. Sampling at each point is done at a depth of 0-30 cm by taking 5 sub points then composit. Soil sampling was done by using composite technique according to Supriyadi et al. (2015) so it can represent conditions of each soil sampling point.

Laboratory analysis

Analysis of physical, chemical and biological properties of soil were conducted at Laboratory of Faculty of Agriculture, Universitas Sebelas Maret, Indonesia. This research was held in July 2017 until September 2017. The physical, chemical and biological indicators analyzed are presented in Table 1.

Table 1
Variable observation of soil quality indicators (physical, chemical and biological properties of soil)

Parameters	Analytical method	Reference
Porosity	Determined from bulk density with a particle density	(Institute of Agricultural Land Resources Research and Development, 2006)
Permeability	Constant Water Height	(Institute of Agricultural Land Resources Research and Development, 2006)
pH	Electrometric	(Soil Research Institute, 2005)
EC	Conductometer	(Soil Research Institute, 2005)
Total N	Kjeldahl method	(Soil Research Institute, 2005)
Available P	Olsen’s method	(Soil Research Institute, 2005)
Available K	Flamefotometry	(Soil Research Institute, 2005)
CEC	Ammonium acetate extraction	(Soil Research Institute, 2005)
BS	Ammonium acetate extraction	(Soil Research Institute, 2005)
SOC	Walkey dan Black	(Soil Research Institute, 2005)
C/N Ratio	Comparison between Organic carbon with total N of soil	(Soil Research Institute, 2005)
qCO_2	Titrimetric	(Anas, 1989)
EH	Electrometric	(Soil Research Institute, 2005)

EC = Electrical Conductivity, CEC = Cation Exchange Capacity, BS = Base Saturation, SOC = Soil Organic Carbon, C/N Ratio = Ratio of Carbon and Total N, qCO_2 = Soil Respiration, Eh = Redox Potential

Data analysis

The results of laboratory analysis of soil quality indicators analyzed the correlation with Pearson Correlation Analysis and continued with Principal Component Analysis (PCA) using Minitab 18 software. The calculation of soil quality was done by summing the indicator score that has been multiplied by weight index. Assessment of soil quality using Soil Quality Index (Liu et al., 2014) which pattern is:

$$SQI = \sum_{i=1}^{n} Wi \text{ x } Si$$

(*Wi*: weighting factor; *Si*: the indicator score for variable *i*).

After obtained data of soil quality analysis in organic soil, then data were compared with data analysis of non organic soil quality. So it can be seen the comparison between soil quality in organic and non organic paddy field.

Results and Discussion

Physical, chemical and biological indicators were used to evaluate the soil quality. Table 2 presents the results of an analysis of organic soil indicators (average of 10 samples) and non organic soil indicators (average of 2 samples) that support soil quality assessment.

The results of laboratory analysis showed that there was a difference of value between organic and non organic soil.

Table 2
Result of analysis of physical, chemical and biological soil properties in Ketapang, Susukan, Semarang, Indonesia

Indicator	Organic	Non Organic
Porosity (%)	$30{,}4^{M}$	$23{,}9^{L}$
Permeability (cm/jam)	$0{,}4^{S}$	$0{,}1^{S}$
pH	$6{,}6^{N}$	$6{,}7^{N}$
CEC (cmol/kg)	$41{,}6^{VH}$	$40{,}2^{VH}$
SOC (%)	$1{,}6^{L}$	$0{,}9^{VL}$
Total N (%)	$0{,}3^{M}$	$0{,}2^{M}$
C/N Ratio	$5{,}7^{L}$	$3{,}8^{VL}$
Available P (ppm)	$13{,}3^{M}$	$16{,}7^{M}$
Available K (cmol/kg)	$1{,}9^{VH}$	$1{,}5^{VH}$
BS (%)	$69{,}6^{H}$	$71{,}5^{H}$
EC (dS/m)	$0{,}6^{VL}$	$0{,}7^{VL}$
Eh (mV)	$231{,}2^{LR}$	249^{LR}
qCO_2 (mg.CO_2/cm/hari)	$0{,}5^{H}$	$0{,}2^{H}$

CEC = Cation Exchange Capacity, SOC = Soil Organic Carbon, C/N Ratio = Ratio Carbon and Total N, BS = Base Saturation, EC = Electrical Conductivity, qCO_2 = Soil Respiration, Eh = Redox Potential, VL = Very Low, L = Low, M = Moderate, H = High, S = Slow, F = Fast, VF = Very Fast, A = Acid, N = Neutral, R = Reduction, MR = Moderate Reduction, LR = Low Reduction

This can be demonstrated by the differences in the value of indicators such as porosity. The value of porosity of organic soil is moderate (30.4%) and in non organic is low (23.8%). Besides porosity, permeability values also showed that organic soil have a higher value than non organic soil although both of them classified as slow. Permeability of organic soil is 0.4 cm/h and on non organic soil is 0.1 cm/h.

Analysis of pH also showed different value, there are organic soil is 6.6 and non organic soil is 6.7 and both of them are classified as neutral. The class of CEC is very high, although the value of organic soil is higher than non organic soil, respectively 41.6 cmol/kg and 40.2 cmol/kg. Total N soil analysis also showed same class but different value, as organic soil is higher than non organic soil, respectively 0.3% and 0.2%. This is followed by the calculation of C/N ratio that shows the organic soil is low (5.7) and non organic soil is very low (3.8).

Organic soil SOC is low (1.6%) and the non organic soil is very low (0.9%). Low SOC content is happen because it was absorbed by plants, it also can be caused by irrigation system, so the process of decomposition and loss of SOC is relatively fast. According with the statement by Ikemura and Shukla (2009), that increases in the cumulative rating with increasing duration of organic farming probably indicate the undercutting of benefits of organic matter additions to the soil due to the adserve impact of tillage that exposes the organic matter to rapid oxidation under the climatic conditions of arid.

BS of non organic soil is higher than organic soil, respectively 71.5% and 69.6% with the same class (high). The qCO_2 analysis also showed that organic soil have higher soil respiration rates than non organic soil, respectively 0.5 (mg. CO_2 cm/day) and 0.2 (mg.CO_2 cm/day) both is high. While available P of non organic soil is higher (16.7 ppm) than organic soil (13.2 ppm). It was happen because of different types and amounts of fertilization. The high content of P were allegedly influenced by fertilization that is done at the beginning of cultivation (Supriyadi et al., 2016). Available K value on organic and non organic soil is classified very high and the value is 1.9 cmol/kg and 1.5 cmol/kg.

EC and Eh in organic soil is lower than non organic soil. EC in organic soil is 0.6 dS/m while in non organic soil is 0.6 dS/m and Eh in organic soil is 231.2 mV whereas in non organic soil is 249 mV. EC and Eh are not so affected by agricultural systems. EC is more influenced by the content of salt or parent material. The variation of EC values are attributed by leaching, composition of parent materials and plants uptake (Mukhopadhyay et al., 2014). While Eh tends to be influenced by flooding water. According to Pezeshki and DeLaune (2012), soil flooding in wetlands is accompanied by

Table 3
Result of correlation analysis between physical, chemical and biological indicator

	Por	SP	pH	CEC	SOC	Total N	C/N Ratio	Av-P	Av-K	BS	EC	$q.CO_2$
SP	-0,2											
pH	-0,3	0,0										
CEC	0,1	-0,3	***-0,6**									
SOC	-0,2	-0,3	-0,1	0,1								
Total N	-0,4	-0,2	-0,1	0,3	0,4							
C/N Ratio	-0,1	-0,3	-0,1	0,0	***0,9**	0,1						
Av-P	0,2	0,0	-0,0	-0,1	-0,4	0,0	-0,4					
Av-K	-0,2	0,2	0,1	-0,1	0,4	***0,7**	0,2	0,0				
BS	-0,2	0,1	0,2	-0,5	-0,2	-0,2	-0,2	-0,2	0,1			
EC	0,0	-0,1	-0,2	-0,1	-0,1	-0,1	-0,1	0,6	-0,2	0,2		
$q.CO_2$	-0,2	-0,3	-0,4	0,5	0,4	***0,7**	0,3	-0,2	0,3	-0,2	0,2	
Eh	0,1	0,2	-0,4	0,5	0,1	0,2	0,0	0,1	0,0	-0,6	-0,2	-0,1

Var = Variable MDS, Por = Porosity, SP = Soil Permeability, EC = Cation Exchange Capacity, SOC = Soil Organic Carbon, C/N = Ratio Carbon and Total N, Av-P = Available P, Av-K = Avaiable K, BS = Base Saturation, EC = Electrical Conductivity, qCO_2 = Soil Respiration, Eh = Redox Potential
This correlation analysis used a level of 5% (α 0.05)

changes in soil physical and chemical characteristics. These changes include the lowering of soil redox potential (Eh).

The physical, chemical and biological indicators have relationships and influence each other. The relation can be explained by correlation analysis. The results of the correlation analysis between these indicators are presented in Table 3.

The result of correlation analysis between physical, chemical and biological indicators showed that there is positive or negative correlation. This correlation analysis used a level of 5% (α 0.05), two indicators are said to have a strong correlation if the Pearson correlation value is approaching 1 or |-1| or P-value less than 0.05. Overall correlation test between indicators, there are only 4 relations that proved to be strongly correlated, include 3 positive correlations and 1 negative correlations. Positive correlation means, if a relation of 2 indicators there is an increase of one indicator, it will cause also increase on other indicator. Otherwise, the negative correlation means that a relation of 2 indicators there is one indicator that increases, then one other indicator will decrease.

The negative correlation (r = -0.6) is indicated by the relation between the CEC and pH, where CEC is dependent on the acidity and alkalinity of the soil. Soil pH in this study ranged from 6-7, so the increases of pH value continuously to alkalin can decrease CEC value. Whereas the soil in high pH will be dominated by basic cations such as Ca, Mg, K and Na. If alkalin cations is too much or dominant in the soil, it will bind other nutrients such as P and make the CEC decrease. So the soil may have a decrease or increase in CEC because of the binding and release of the elements in the soil.

While the positive correlations is indicated by the relation of 2 indicators, including the relation between C/N ratio with SOC, available K with total N, qCO_2 with total N. The correlation analysis results showed a positive correlation (r = 0.9) between C/N ratio and SOC content as evidenced by the increase of SOC cause also increase in C/N ratio value. With the same total N content, if SOC increases, it will increase C/N ratio, and in otherwise if organic soil SOC decreases, then C/N ratio will also decrease because SOC function in C/N Ratio is as divisor. So C/N ratio with SOC can be said positively correlated.

Based on correlation analysis, available K also positively correlated with total N (r = 0.7). Increasing total N will be followed by the increase of available K, and vice versa. Giving organic matter to the soil can be interpreted to give N into the soil, and one of the available K criteria in the soil is the K that binds (weakly) with humus (Hardjowigeno, 2007). So with the giving of organic matter into the soil means increasing the total N of soil and also increasing the available K.

qCO_2 with total N also proved to be positively correlated (r = 0.7). The qCO_2 value indicates the high level of total microbial in the soil. Soil microbes play an important role in the assimilation of N in the soil. The higher number of soil microbes make the higher activity in the soil, including the assimilation of N. So is the opinion of Noviyanto et al. (2017), who say that in the soil the nitrogen element is in organic form and waste decomposition can increase the total N. Organic nitrogen can be changed to ammonium ($NH4^+$) by microorganisms. So it can be said that qCO_2 and N total are positively correlated because the increases of qCO_2 will increase the total N.

Soil quality assessment was performed using the minimum data set (MDS) that selected from the analyzed physical, chemical and biological indicators. The selected indicators as MDS are presented in Table 4.

Selection of indicators as MDS is done by choosing a PC with eigen value (≥1). PCA analysis results showed that there are 4 PC selected as the principal component and there are 9 indicators as MDS. The selected indicator as MDS is the high rated indicator on each PC and another indicators that correlates with the high indicator. In PC 1 selected indicator are C/N ratio, SOC, total N and qCO_2, where they are positive correlated. In PC 2 there were 2 selected indicators which are CEC and Eh. In PC 3 there are 2 selected indicators, which are available P and EC. Two indicators with highly weighted, but were not well correlated, still retained for calcuating index with independent proportion. In PC 4 there is 1selected indicator which is soil permeability.

Table 4
Analysis results of Minimum Data Set (MDS) using PCA

Eigenvalue	3,4	2,5	1,8	1,6
Proportion	0,3	0,2	0,1	0,1
Cumulative	0,3	0,4	0,6	0,7
Variable	PC1	PC2	PC3	PC4
Porosity	-0,1	0,3	-0,3	-0,2
SP	-0,2	-0,1	0,0	***0,5**
pH	-0,2	-0,4	-0,0	0,0
CEC	0,3	***0,4**	-0,0	0,0
SOC	***0,4**	-0,2	-0,2	-0,1
Total N	***0,4**	-0,1	0,4	0,2
C/N Ratio	***0,4**	-0,2	-0,3	-0,2
Av-P	-0,2	0,3	***0,5**	-0,0
Av-K	0,2	-0,3	0,3	0,3
BS	-0,2	-0,3	0,2	-0,2
EC	-0,1	0,2	***0,4**	-0,4
q.CO2	***0,4**	0,0	0,3	-0,2
Eh	0,2	***0,4**	-0,1	0,4

CEC = Cation Exchange Capacity, SOC = Soil Organic Carbon, C/N Ratio = Ratio Carbon and Total N, BS = Base Saturation, EC = Electrical Conductivity, qCO_2 = Soil Respiration, Eh = Redox Potential, PC = Principal Component

According to Mukhopadhyay et al. (2014), the first step is dividing proportion by the number of *Mine Soil Quality Index* (MSQI). Than the MSQI values were normalized to a 0-1 scale by dividing each weighing factors by the total weighing factor. The total weighing factor on this analysis is 0.7. After that the number is multiplied by the score of each indicator (Si). Scoring of soil quality index use a linear method, where the assessment is performed by assigning values in the range from 1 to 4 (Si). The number 1 showed the lowest range of scoring and progressively rises to 4 indicating the highest value. The higher indicator value indicates the better of the soil or the better soil in performing its function.

Based on the histogram of cufting according to Cantu et al. (2007), it can be seen that organic and non organic soil has the same class except the SOC, C/N ratio and porosity. SOC in organic soil has higher value than non organic soil because the inputs that are given to the organic soil are different from non organic soil. Organic fertilizers contribute more to SOC than synthetic fertilizers. This is in accordance with the statement by Komatsuzaki et al. (2010), who state that organic farming leads to soil with significantly higher soil carbon storage capacity than conventional farming. This

Table 5
Soil Quality Index in each farming system

Var	Pro	Cum	Wi	Organic	Non Organic	Wi x Si (Organic)	Wi x Si (Non Organic)
				Si			
SOC	0,3	0,7	0,2	3	2	0,5	0,4
Total N	0,3	0,7	0,2	2	2	0,4	0,4
C/N Ratio	0,3	0,7	0,2	2	1	0,4	0,2
qCO2	0,3	0,7	0,2	4	4	0,4	0,7
CEC	0,2	0,7	0,3	3	3	0,8	0,8
Eh	0,2	0,7	0,3	4	4	1,0	1,0
Av-P	0,1	0,7	0,1	1	1	0,1	0,1
EC	0,1	0,7	0,1	1	1	0,1	0,1
Permeability	0,1	0,7	0,2	1	1	0,2	0,2
SQI						4,2	3,9
Score						3	3
Class						Medium	Medium

Var = Variable MDS, Cum = Cumulative, SQI = Soil Quality Index, Wi = weighting factor, Si = the indicator score for variable i, SOC = Soil Organic Carbon, C/N Ratio = Ratio Carbon and Total N, BS = Base Saturation, qCO_2 = Soil Respiration, Eh = Redox Potential statement is reinforced by Surekha et al. (2013) who state that the soil organic carbon (SOC) stocks were higher with organics compared to conventional system during wet and dry seasons, respectively, after five years of study. Some management mesures, such as fertilization and irrigation in the apple production system, can significantly affect soil organic carbon content (Ge et al., 2013). C/N ratio in organic soil is higher than non organic soil, because SOC content in organic soil is also higher than non organic soil. With the same total N content, if SOC increases, it will increase C/N ratio, because SOC function in C/N Ratio is as divisor. Porosity in organic soil was higher than in non organic soil. Porosity in organic soil is higher supported one of them by the content of organic material. Addition of biomass increased the water retention characteristics, number of macro- and mesoporosity (Eusufzai and Fujii, 2012). The basic character of the pore space affects and is affected by critical aspects of almost everything that occurs in the soil – the movement of water, air and other fluids, the transport and the reaction of chemical and the residence of roots and other biota (Nimmo, 2004).

From the calculation of SQI can be seen that there are 10 indicators that have the same index in organic and in non organic soil. These indicators include permeability, pH, CEC, total N, available P, available K, BS, EC, Eh and qCO_2. This may indicate that the conversion of farming system from non organic into organic farming system after 8 years still presents the same class of several indicators. Management of organic farming system has not directly changed the soil. pH is commonly used to describe water quality (Boyd et al., 2011). BS and available P is affected by pH, and soil pH tends to remain at all times. Eh changes only when the ground is flooded or dried. The strongest drop of redox potential (Eh) was observed during the first day of soil flooding (Wlodarczyk et al., 2007), whereas EC in the soil is influenced by the parent rock.

CEC, total N, available K and qCO_2 in organic and non organic soil have the same index, but from the analysis showed that the value of CEC, total N, available K and qCO_2 in organic soil is higher than in non organic soil. This can be caused by the management system and fertilizers which are given to these two different agricultural systems. Organic fertilizers are more environmentally friendly so that organic rice fields support more the growth of microbes. Alternative

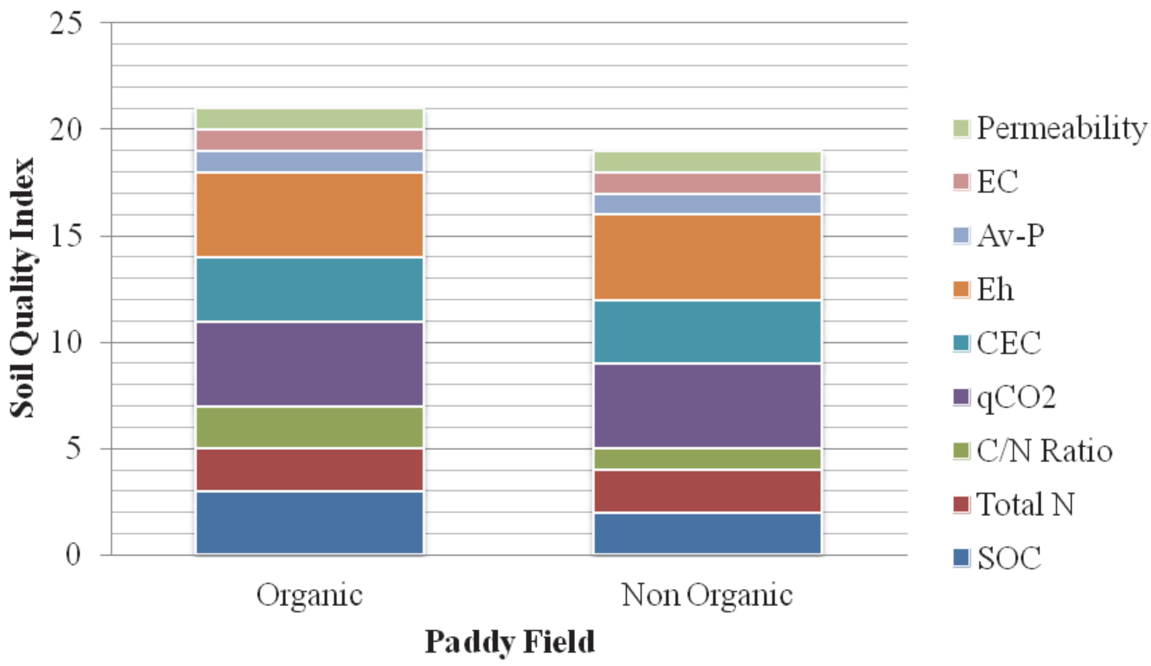

Fig. 1. Soil Quality Index (SQI) of organic and non organic paddy field
SOC = Soil Organic Carbon, C/N Ratio = Ratio Carbon and Total N, qCO_2 = Soil Respiration, CEC = Cation Exchange Capacity, Eh = Redox Potential, EC = Electrical Conductivity

sources of soil fertility build up the nutrient supply capacity for achieving non-polluting environment (Sharma et al., 2017).

According to Cantu et al. (2007) modified, both organic and non organic soils, belong to class 3 (Medium). Based on assesment of SQI (Soil Quality Index) value, organic soil has bigger SQI value that is 4.2 than non organic soil (3.9). This difference in SQI values indicates that organic soil have better soil properties than non organic soil. This can happen because of differences in management on both agricultural systems. According to Van Leeuwen et al. (2015), the organic farms differed from the conventional farms in that only organic fertilisers were applied and no pesticides were used. Giving different fertilizers will cause different soil properties, although indirectly. One of them is that organic soil has a higher biological activity compared with non organic soil because of organic fertilizers. Indirectly, it will affect the availability of nutrients or physical properties of the land. This is like opinion by Van Leeuwen et al. (2015), that soil organism biomass, especially of bacteria and nematodes, was consistently higher on organic farms than on conventional farms.

This is because of the difference of input given to organic and non organic soil. Inputs on organic soils tend to contribute higher organic materials such as compost and manure. Condron et al. (2000) conclude that the key characteristics of organic farming are protecting the long-term fertility and quality of the soil, providing nutrients in natural and organic fertilizers, nitrogen self-suffiency through legumes, weed, disease and pest control through crop rotations, natural predators, diversity, organic manuring and limited biological and chemical intervention, extensive management of livestock, minimising the impact on the wider environment.

Differences in the management of organic and non organic soil can be seen in the inputs are given. Organic farming system generally uses safe environmentally products such as manure, compost and organic fertilizers. While non organic farming systems in general use synthetic fertilizers that have more negative impact on the environment either directly or indirectly. This difference in management causes different physical, chemical and biological characteristic. So is the opinion of Ikemura and Shukla (2009), that organic agriculture is aimed at producing high quality food produce that is not only rich in nutrients but also contributes to health care and well-being of mankind. Since organic farming eliminates the use of most conventional fertilizers, pestisides, animal drugs and food additives, it can improve soil, water and environmental quality and thus improve the overall quality of life.

Conclusion

The analyses of soil quality indexes can be used for assessment or comparison of different soils. Principal indicators for soil quality assessment are SOC, total N, C/N ratio, qCO_2, CEC, Eh, available P, EC and permeability. Soil quality index (SQI) on organic and non organic paddy field was included in low category, however the value of both indexes was different. Organic soil have a higher SQI (4.2) than non organic soil (3.9). This indicates that organic paddy fields are better than non organic paddy fields as seen from the character of the soil. This research showed that conversion from non organic paddy field to organic paddy field takes a long time, proven for 8 years of conversion has not been able to change or improve the overall soil properties. The difference between organic paddy field and non organic paddy field was presented by just several indicators such as SOC, C/N ratio and porosity. Soil quality can be improved in various ways, including with the use of organic fertilizers that supply more of organic material.

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