Potential of heavy metal cd, pb in affecting non-organic agricultural land levels

Hening Widowati¹, Agus Sutanto, Achyani, Fenny Thresia, Nedi Hendri

¹University of Muhammadiyah Metro

*hwummetro@gmail.com

Abstract. Non-organic farming is not environmentally friendly, its management operations involve a lot of material that has the potential as a pollutant and free radicals, can affect the quality of the land of agricultural land. This study examines the presence of Cd, Pb heavy metals which can influence the nutrient levels of agricultural land. The study was conducted using the expose facto method, randomly taking 8 types of soil samples of agricultural land products with 4 replications in the agricultural land of Karangrejo Sub-District, Metro Utara, Metro Lampung City, in April 2019. Furthermore, samples were analyzed for the heavy metal content of Cd, Pb, N, P, K in the hope of knowing the relationship related to the availability of nutrients in agricultural land. Regression analysis and T-test showed that there were differences in the influence of the presence and levels of Cd, Pb metals on N, P, K levels in agricultural land. Heavy metals Cd, Pb contribute to suppressing levels of N, P, K in non-organic agricultural land.

Keywords: Cd metal, Pb; NPK nutrient levels; non-organic agriculture

1. Introduction

Technology is a method or method and process or product that results from the application and utilization of various scientific disciplines that produce value for meeting the needs, sustainability, and improving the quality of human life [1]. From this understanding gives an understanding that technology is a human effort to advance in all aspects of life, including in agriculture. Agriculture is a type of productive activity by managing the growth process and animals (including plants, livestock, and fish) to produce a product that is far better than if the plants and animals lived naturally. These products, in turn, are used to meet human needs to sustain life. This agricultural production is mainly in the form of food.

Based on this understanding, technology in agriculture means a human effort to produce agricultural products, especially food better through the application and use of various scientific disciplines. The results of spectacular agricultural technology have resulted in a revolution in agriculture, which has been shown, including the discovery of various superior varieties, high productivity, resistant to pests and diseases, nutrient-rich fertilizers, effective pesticides to eradicate pests, and so on. But we too have witnessed how the revolutions in agriculture have harmed the survival of life itself. Technology in agriculture that is characterized by greed and greed and the neglect of life's values has the potential to destroy human dignity and natural quality standards. Agricultural land is in danger of running out because it prioritizes land for industrial activities [2]. Today's technology has indeed penetrated
The soil parent material is weathered resistant; 13) Plant cover is too little; 14) Low biodiversity in the soil (especially microorganisms is a factor and indicator of fertility, for example, to make holes that add soil pores, accelerate weathering of organic matter, produce impurities, which are actually used by plants for nutrient needs); 15) Irreversible nature of the soil (if the soil has been damaged due to improper processing, then the nature of the soil cannot be returned to normal). From the interviews of researchers in November 2018 and April 2019, it is known, the management of vegetable farming in the study site is non-organic, routinely using synthetic chemical active ingredients from fertilizers, herbicides, insecticides, fungicides, pesticides, even to the physical management of the soil for example in plowing using tractors involving fossil fuels, oil in its spare parts, which indirectly involves materials containing heavy metals Cd and Pb. The results of these interviews and observations reinforce the notion that vegetable farming in the place of research management also provides opportunities to reduce soil fertility. Based on this conjecture, this study aims to examine the presence of Cd, Pb heavy metals which can influence the nutrient levels of vegetable farming land, specifically the influence and contribution of Cd, Pb heavy metals in influencing N, P, K levels as a key nutrient for productivity vegetable plant. As is known [4] N, P acts as a basic constituent of proteins, polysaccharides, fats, nucleic acids, and energy production of ATP; P is important in the carbohydrate metabolism; K for translocation of sugars in phloem vessels and enzyme activators.

2. Materials And Methods
This research material includes: soil from 8 types of spinach, cai sim, rice, basil, jelly, pakcoy, rice, and lettuce, with 4 replications taken in the environment where it was planted, namely vegetable farming Karangrejo Metro Lampung sub-district in April 2019, which was managed in a managed manner non-organic, routinely adding synthetic chemical fertilizers including Bigges, Gandasil, Urea, NPK, its management to control pests using insecticides and synthetic chemical fungicides. Scorsis to
eradicate the fungus, Regent is to eradicate the stinky bugs and grasshoppers in general, Plainumis to eradicate planthopper, Amistartopis to eradicate the fungus, Gordon is to eradicate the caterpillar, Kempo is to eradicate leaf borers. The land was managed by tractors, as well as periodic manual ground-breaking. Samples were taken by using trowel, each sample of 100 gram vegetable biomass was put in a plastic bag and given sodium benzoate, then analysed at the Chemical Analysis Laboratory of the University of Muhammadiyah Malang with the UV-vis spectrometry method, to detect levels of Cd, Pb, N, P, K contained in soil samples of non-organically managed agricultural products. Data were analysed with the help of SPSS version 21 application using the T-test to determine the potential influence of heavy metals Cd, Pb on N, P, K and correlation, regression, to determine the amount of contribution in influencing soil nutrients N, P, K.

3. Results and Discussion

Preliminary research observational data shows that water and soil in which vegetables are planted contain heavy metals Cd, Pb which generally exceeds the specified threshold. In the soil found around 0.30-1.09 ppm Cd and 0.46-1.68 ppm Pb in soil, and water found 0.023-0.027 ppm Cd and 0.0722-0.0876 ppm Pb. Which according to the maximum provisions of Cd in water and soil the environment is 0.01 ppm, and Pb is 1 ppm. So in general, has exceeded the specified threshold. The research data was recorded on the average levels of heavy metals Cd, Pb, N, P, K in agricultural products in the study location contained in Table.

| Soil Samples Types of Agricultural Products | Total Cd (mg/kg) | Total Pb (mg/kg) | P2O5 Bray (mg/1000 g) | N Total (g/100 g) | Total P2O5 (mg/100 g) | Total K2O (mg/100 g) |
|---------------------------------------------|-----------------|-----------------|----------------------|------------------|----------------------|---------------------|
| Rice Soil                                   | 0.3024          | 0.461875        | 8.43855              | 0.577175         | 38.574625            | 43.71125             |
| Lettuce Soil                                | 0.77885         | 1.1978          | 3.28865              | 0.23625          | 15.065175            | 17.021725            |
| Basil Soil                                  | 0.93115         | 1.4334          | 3.732025             | 0.187625         | 17.109675            | 19.343975            |
| Caisim Soil                                 | 0.688925        | 1.05865         | 2.845675             | 0.2162           | 13.02255             | 14.70165             |
| Pak coy Soil                                | 0.93645         | 1.441625        | 3.971275             | 0.2567           | 18.206225            | 20.584               |
| Water spinach soil                          | 1.091275        | 1.6812          | 2.1776               | 1.118175         | 9.9523               | 11.206725            |
| Spring onion soil                           | 0.872375        | 1.342525        | 3.70965              | 0.209375         | 16.996775            | 19.205125            |
| Spinach soil                                | 1.5165          | 0.79215         | 4.958325             | 0.2642           | 22.724025            | 34.301375            |

The average condition of the soil of agricultural products in the research location can be visualized in the following diagram.
The results of the analysis test using SPSS version 21, between heavy metals Cd, Pb against soil nutrients (NPK) can be set out in Table 2, the recapitulation of the results as follows.

### Table 2. Recapitulation of T-Test Results, Correlations, and Regression of Cd, Pb Heavy Metals to NPK Soil 8 Types of Agricultural Products

| Type of heavy metals | A | N | Regression T-test | a Correlation | P | Regression T-test | a Correlation | P | Regression T-test | a Correlation | P | Regression T-test | a Correlation | P | Regression T-test | a Correlation | P | Available P | a Correlation | P |
|----------------------|---|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------|---------------|---|
| Cd                   | .044 | - | - | .020 | .000 | .020 | .169 | .015 | .000 | .153 | .06 | .000 | .061 | .08 | 8.3 | % |
| Pb                   | .000 | - | - | .000 | .000 | .000 | .688 | .000 | .015 | .153 | .06 | .000 | .061 | .08 | 3 | 87 | 3 |

Table 2. Recapitulation of the T-test, Correlation, and Regression, generally shows that there is a correlation between heavy metals Cd, Pb on soil NPK nutrients, there is a significant and very significant difference between the presence of heavy metals and soil nutrients, so that the percentage is low or high heavy metals Cd, Pb contributes to the influence of soil NPK nutrients. The heavy metal Cd, Pb significantly influences the available P levels, as a nutrient that is ready for plants to use. From the analysis of data showing heavy metals Cd, Pb contributes a significant influence on soil fertility. Compared to Cd, Pb metal is more contributing to influence the total P, available P, and K nutrient levels of 67.3-86.5%. Whereas Cd only contributed to 8.3-16.9%. Concerning to N, although the two Cd metals, Pb shows a difference, yet the correlation with N is very low, so the results of the statistical analysis do not indicate that they contribute to the availability of N nutrients.

Fertile land is important for agriculture because it is profitable. In contrast to infertile soils, an attempt is made to fertilize the land so that the benefits are increased. Soil Fertility is the ability of a soil to produce the desired crop products, in the environment where the soil is located. These plant products can be fruit, seeds, leaves, flowers, bulbs, sap, exudates, roots, stems, biomass, shade or appearance. Soils have different fertility depending on the soil-forming factors that dominate the location, namely: parent material, climate, relief, organisms, or time. The land is the main focus in the discussion of soil fertility, while plants are the main indicator of soil fertility quality [5].

The release of hazardous organic and inorganic compounds into the environment by human behavior such as disposal of industrial waste that has not been treated properly. As a result, there will be changes in physical, chemical, and biological properties that are undesirable to the soil, water, and air which can then have an impact on the lives of living things and their habitats.

The soil naturally contains various metal elements, the dominant metal elements are Si, Al, Fe, Ca, Na, K, Mg, the metal elements in this soil come from weathering rocks (parent rock), and the presence of elements this will have a profound effect on the physical and chemical properties of the soil [6]. These metals generally include metals which have a specific gravity of fewer than 5 grams / cm3 or are not heavy metals. While metals that should not be too much on the ground are heavy metals. This metal has a specific gravity of more than 5 grams / cm3 with atomic numbers 22 to 92 located in periods 4 to 7 in a periodic arrangement and has a high affinity for the S element to encourage the occurrence of heavy metal bands with the S group [7]. Excessive heavy metals cause pollution in the soil. [7] explains that heavy metal elements that have the potential to cause pollution to the environment are;
Fe, As, Cd, Pb, Hg, Mn, Ni, Cr, Zn, and Cu, because this element has more extensive use as well as a high level of toxicity. While the United State Environment Protection Agency (US EPA) records heavy metals which are the main dangerous pollutants, namely Sb, Ag, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Sr, Ag and Zn [8] but there are also heavy metals such as Cr, Cu, Fe, Mn, Mo which are essential micronutrients for plants, but if the amount is too large it will be toxic to plants. The presence of toxins in the soil, especially if the metal has accumulated and has exceeded the critical limits in the soil. [6] says that excess heavy metals in the soil not only poison plants and organisms but can have implications for environmental pollution. [9] and [10] describe heavy metals in soil consisting of various forms, such as forms bound to organic particles, reduced form (hydroxide), carbonate form, sulfide form and form of a solution in the soil. Heavy metals found in the soil or sediments can carry out ion exchange and absorption processes, especially on fine particles with large surfaces and negatively charged groups, such as clay (kaolinite, chlorite, montmorillonite) humin substances (humic acid, humic acid, humic acid) and Fe and Mn oxides. Heavy metals are contaminants because they are stable and difficult to decompose. It was also explained that heavy metals in the soil that are harmful to the life of organisms and the environment are in dissolved form. However, heavy metals in the soil can form complexes with organic matter in the soil so that it becomes an insoluble metal. The metal which is bound into an organic complex is difficult to wash and relatively unavailable to plants. Thus the soil organic compounds can reduce the potential hazards caused by toxic heavy metals.

Toxic dangerous heavy metals that are in the soil including agricultural land indicate the region is experiencing environmental problems. Environmental problems that can cause damage to the soil according to [11] can be grouped into chemical damage to the soil characterized by loss of soil fertility and chemical elements that are not needed by plants and humans/animals that consume them.

From the research conducted it can be assumed, the use of chemicals in land management adds to the burden on the soil. As we know, synthetic chemicals will damage the soil structure. Thus causing ionization of heavy metals, which can poison plants that live on it, including degrading microbes that should benefit the formation of arable land. Likewise, the disruption of life in the soil will reduce soil organic matter. As revealed by [5], that the use of organic material can be one of the alternatives chosen, because based on experimental results the use of organic material in polluted paddy soils can inhibit the absorption of heavy metals in the roots. Thus its existence is considered environmentally friendly and sustainable for the crop production system above. In the concept of organic farming, organic fertilizers play an important role to reduce the use of inorganic fertilizers that have the potential to pollute the environment and to restore the fertility of soils that have suffered setbacks due to continuous nutrient depletion. Utilization of organic material can indirectly act as a method of improving soil fertility and improving plant nutrition.

No matter how good the efforts to repair soil contaminated with heavy metals, if the source of the pollutant still contains compounds that can contaminate the soil, then it will not produce meaningful results. Coordination is needed by involving the support of various parties, both from the local government, business people and the local community to preserve the environment, including river water and surrounding agricultural lands. Thus this land rehabilitation activity is not only a burden on farmers but also includes elements related to the surrounding.

4. Conclusions and Suggestions
Based on the research it can be concluded that in general there is a correlation between heavy metals Cd, Pb to soil NPK nutrients, there is a significant and very significant difference between the presence of heavy metals and soil nutrients, so that with low and high percentage of heavy metal Cd, Pb contributes affect soil NPK nutrients. The heavy metal Cd, Pb significantly influences the available P levels, as a nutrient that is ready for plants to use. From the analysis of data showing heavy metals Cd, Pb contributes a significant influence on soil fertility.
Suggestion:
Even though the heavy metal detected is very small, below the permitted threshold, but because it is difficult to degrade and is bio accumulative, it is still important and absolutely watchful in farming using synthetic materials that are predicted to add heavy metals and free radicals, for example, chemical fertilizers, insecticides, and fungicides, because they have been shown to significantly affect soil fertility, so indirectly non-organic farming is important to watch out for because at the peak it will affect the balance of the ecosystem which ultimately damages the environment, even though it provides a temporary financial benefit.

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