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Identification of Organophosphate Pesticides Reside on Tomatos, Potatoes, Chilis, Cubes, Carrots, Soil and Water In Garut, Indonesia In 2017

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Abstract

Background: Food requirements including vegetables every year always increases along with the growth of the population. To meet these requirements there is no other way instead of it must be done intensively. Intensification of agriculture will not be separated with the use of pesticides. **Objective:** Organophosphate pesticides are widely used by vegetable farmers in Garut region of West Java. Meanwhile, the quality and safety of vegetables produced must be healthy and safe. This study aims to identify residual content of organophosphate in Potato, Cabbage, Chili, Tomato and Carrot and residue test of Organophosphate group on water and soil in the District of Cikajang District, Regency of Garut in 2017. Samples come from agricultural land in District of Cikajang. The research was conducted by sampling vegetables, soil, water composites in farmers' land as much as 3 samples each. Samples were examined by gas chromatography method with ECD detector according to standard method. Examination of organophosphate pesticide residual test shall include examination with Dichlorvos, Dimethoate, Diazinon, Fenittothion, Chlorpyrifos, Parathion, Methidathion and Profenofos active ingredients. In addition, field observations on farmer behavior in using pesticides were also conducted. **Results:** The results showed, based on these results, it is detected that profenofos concentration in chili vegetables is above the maximum limit of residuals established by the Indonesian National Standard 2015 that is 3.0 mg/kg. The concentration of profenofos in tomato vegetables is still below the maximum limit of residuals as defined by the Indonesian National Standard that is 2.0 mg/kg however it has passed the RfD US-EPA standard in 2006 that is 0.00005 mg/kg/day. Pesticide residue of organophosphate group is not detected as exist in Soil and water samples. Observation of farmer behavior indicates that it has not been or is not environmentally friendly. They mix some types of pesticides without rules but by felling. They do not wear any PERSONAL PROTECTIVE EQUIPMENTS, sometimes even while smoking, they throw away pesticide packaging carelessly. With no detection of profenofos in some vegetables there are several possibilities. **Conclusion:** It is necessary to examine the content of active ingredients of pesticides at the merchant level and consumer level in order to compare the content of the authenticity of active ingredients of the remaining pesticides. It is necessary as well to conduct supervision and development by the government on the use of pesticides so that the health impacts and the environmental impacts can be minimized.

Key words: Pesticide Residue, Organophosphate, Potato, Cabbage, Chili, Tomato, Carrot Water, and Soil

INTRODUCTION

The increasing number of people in Indonesia is always balanced with the requirements of clothing and food. Food requirements alone shall include vegetables. Food and vegetables very important to human life besides the habits of clean and healthy living behaviour (Suyud *et al*., 2016). Due to the existence of limited vegetable land for development, the intensification efforts cannot be avoided. This intensification effort cannot be separated as well with the use of pesticides. Various types of pesticides have been widely used by farmers with average low educated. The use of excessive pesticides or the use that is not according to the rules may cause pesticide residues in vegetable products as well as on environmental media such as soil and water, because all of the activites can be impact to biotic and abiotic components (Rauf, A.S., *et al*, 2015). Increased demand for vegetables coupled with consumer concerns about the quality and safety of foods, that the vegetables produced are less healthy and safe. In vegetables such as carrots, tomatoes, lettuce, spinach and potatoes, the concentration of synthetic pesticide residues is significantly higher in conventional products (Hoefkens, C., *et al*., 2009). Consumers want certainty to know that the products being consumed shall be the vegetables that are free of pesticides, having good physical characteristics and bright colors. Research on the level of potato traders showed that from 5 samples, the value of pesticide residue was <0.1 mg/kg. The residual content of chlorpyrifos pesticides in all potato samples is still below the device detection threshold (Yusnani, A.D., 2013). Although pesticide groups of chlorophosic organophosphate species is detected in samples sold in the market, there are still on the threshold. It is also necessary to know the residues of pesticides on fresh vegetables at the farmers' garden level directly and to know the content of pesticides in soil and water media.

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The use of pesticides in addition to causing a positive impact for farmers, it also has a negative impact. Negative impacts caused by pesticides are the occurrence of environmental damage and ecosystem imbalances and cause poisoning for humans that can lead to death due to the emergence of various degenerative diseases (Hernayanti). Even though food is a basic necessity for human life and consumers had the right to healthy food access (Suyud, W.U. and Guntur, A.T., 2016). Environmental pollution is the entry or inclusion of living things, substances, energies and/or other components into the environment and or the changing of the environmental order by human activities or by natural processes, so that the quality of the environment becomes less or no longer functioning according to its designation (Presiden, R.I., 1982). The use of pesticides can have undesirable effects on human health and the environment. It is reported that 60-90 percent of applied pesticides will be left on targets, while the rest will evaporate with wind or reach the ground (Sudarmo. Pestisida. yogyakarta: Kanisius; 1990). Pesticides are also adversely affecting aquatic populations such as fish and shrimp. Pesticides are toxic to different types of fish species. Pesticide residues in the environment are the result of the use or application of certain pesticides aimed at specific targets such as plants and soil. Residues can also be caused by pesticides carried by water movements such as rivers, water, soil and by wind/air movement. Pesticide residues are chemical substances contained in agricultural products, foodstuffs or animal feeds either as a direct or indirect result of the use of pesticides (komisi pestisida). The use of pesticides in agriculture negatively affects the life of soil organisms such as earthworms, predatory mites that prey on soil collembola. Soil is a pollutant reservoir and through the pesticide-residue soil it can cause other pollution (M_Sodiq_Mapeta_2000). The use of agrochemicals tends to be excessive in vegetable production centers, and it is indicated that in some agricultural production centers the residual content of pesticide residues in vegetables has exceeded the maximum limit of residuals (Soejitno. 2002). The maximum limits condition of pesticides in agricultural system as a pollution. This condition must be controlled to prevention and mitigation land degradation (Suyud *et al*., 2016).

Regency of Garut can be regarded as agriculture-based districts. The main commodities in the District of Cikajang include vegetable farming of Potato, Cabbage, Carrots, Chili and tomatoes (BPS. CIKAJANG DALAM ANGKA, 2014). Ten major outpatient diseases based on data from the Community Health Centers of Cikajang that shall include: Acute Respiratory Infections (ISPA), Gastritis, allergic cough, dermatitis, myalgia, allergic skin diseases, gastroenteritis, hypertension, and headache are estimated that most of such diseases are associated with the exposure to pesticides. Previous research found that pesticide residue in tomato vegetables showed that pesticide residues were analyzed from the samples taken (Luthfiah_Skripsi_FKM. 2016). It is necessary to understand whether there are residues of Organophosphate Group pesticides left on Potato, Cabbage, Chili, Tomato and Carrot vegetables and Organophosphate Group Residues at water and soil environment in the District of Cikajang, the Regency of Garut in 2017.

Method Of Research:

This type of research is the survey / observational with the descriptive approach. Pesticide identification was done in laboratory using gas chromatography test. Determination of sample by random sampling. The sample of this study consists of samples of Potato, Carrots, Cabbage, Chili and Tomato as well as Environment Samples i.e. Water and Soil samples. Location the sampling was done in the central agricultural area in the District of Cikajang, the Regency of Garut in November 2017. The research location was based on preliminary survey through interviews with farmers, field officers, pesticide sellers. Number of samples of vegetables, soil and water are each of 3 samples. In addition, field observations were made as well on how farmers spraying, mixing the existing pesticide packaging, the use of Personal Protective Equipment, storing the remaining packaging, discarding the packaging and maintaining hygiene behavior after spraying.

Sampling of potato, tomato, cabbage, carrot and chili vegetables in cultivated harvest field in the District of Cikajang, Regency of Garut is done by wrapping the relevant samples in aluminum foil then put the relevant sample into plastic or sterile container before taking the same to the laboratory in order to test the pesticide exposure. Samples of cabbage, carrot and chili vegetables were taken at 3 points and each weighed 2 kg, the sample was weighed directly at the location of the farmer's plantation. Insert the relevant samples into aluminum foil paper and wraps the same in plastic. After that the samples were sent to the Central Laboratory of Quality Testing and Promotion of Agricultural Products in Cibubur, East Jakarta in order to examine the level of Pesticide residues. Residue test was performed to determine residual content in potato, tomato, cabbage, carrot and chili vegetables.

Water samples taken up from river water source from upstream, middle and downstream agricultural areas. Water samples are mixed water samples from 3 individual water samples. The water sample taken is water below the surface with a depth of 0-100 cm. Samples are mixed, then taken as much as 500-1000 ml to be inserted into the container and labeled containing the information regarding: code, date of taking, and location (village, district, and regency). Soil samples were taken composite at a depth of 0-20 cm. One sample of composite soil is a composite of individual sample (4-5 samples) taken at a radius of 50-100 m. A 1 kg composite soil sample was put into a plastic bag and labeled. The soil samples were dried, mashed and sieved with a 2 mm sieve. Sample of soil is analyzed at the laboratory of Plant Product Quality Testing Agency which shall include residual organophosphate. The organophosphate residue analysis in soil samples carried out by methods established by the Directorate General of Food Crops and Pesticide Commission (komisi pestisida).

RESULTS AND DISCUSSION

1. Concentration of Residues of Pesticide Group of organophosphates on Potato, cabbage tomatoes, carrots and chili vegetables:

Examination of the test of residues of pesticide group of organophosphates shall include examination with active ingredients of Dichlorvos, Dimethoate, Diazinon, Fenittothion, Chlorpyrifos, Parathion, Methidathion and Profenofos. The test report found that chili and tomato are the only vegetables that are detected to contain with pesticide residue, with active ingredient of profenofos, while potato, cabbage and carrots vegetables are not detected to contain with residues of organophosphate groups.

Table 1: Concentration of Pesticides on Potatoes, Tomatoes, Cabbages, Carrots and Chili Vegetables at Horticulture Farmer in the District of Cikajang, Regency of Garut in 2017

No	Sample	Concentration of Detected Pesticide (mg/kg)	Sampling Location
1	Potato Sample I, II, III	Not detected	Farmer's garden
2	Tomato Sample I	Being detected with profenos 0,069	Farmer's garden
3	Tomato Sample II	Being detected with profenos 0,189	Farmer's garden
4	Tomato Sample III	Not detected	Farmer's garden
5	Cabbage Samples I, II, III	Not detected	Farmer's garden
6	Carrot Samples I, II, III	Not detected	Farmer's garden
7	Chili Sample I	Being detected with profenos 3,3065	Farmer's garden
8	Chili Sample II	Being detected with profenos 1,2045	Farmer's garden
9	Chili Sample III	Being detected with profenos 11,193	Farmer's garden

Source: Primary Data of 2017 except Martanto-sourced Chili (2017)

Based on these results, the profenofos concentration in chili vegetables is above the maximum limit of residuals established by the Indonesian National Standard in 2015 that is 3.0 mg/kg (PERATURAN MENTERI PERTANIAN REPUBLIK INDONESIA NOMOR 2015). Profenofos concentration in tomato vegetables is still below the maximum limit of residuals established by the Indonesian National Standard that is defined as 2.0 mg / kg however it has passed the RfD US-EPA standard in 2006 that is 0.00005 mg/kg/day (EPA 2006).

2. Concentration of Residues of Pesticide Group of organophosphate on water and soil

Residue of pesticide was analyzed by using chromatographic tool in this research, pesticide residue was not detected on soil and water sample.

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Table 2: Organophosphate residue levels in soil and water samples in the District of Cikajang, Regency of Garut

Compounds being examined	Soil Samples	Water Samples
Diclorvos	Not detected	Not detected
Dimethoate	Not detected	Not detected
Diazinon	Not detected	Not detected
Fenitrothion	Not detected	Not detected
Chlorpyrifos	Not detected	Not detected
Parathion	Not detected	Not detected
Methidation	Not detected	Not detected
Profenofos	Not detected	Not detected

Source: Primary Data of 2017

The absence of organophosphate compounds in soil and water can be caused by persistence of profenofos about 2 days under aerobic conditions (Ardiwinata, A.N., SYJESH. 2007). Each active ingredient has different water solubility, such as chlorpyrifos in the soil is more persistent than profenofos, which is about 60-120 days. The reactivity of the group of organophosphates to the soil varies so as to affect its accumulation in soil (Soejitno 2005). The existence of pesticide residues in the soil is closely related to the content of soil organic matter. The higher the soil organic matter content, the stronger the pesticide residue. Pesticides tend to accumulate in a layer of soil with a depth of 10-20 cm because the layer contains a lot of organic material so that pesticides are easily adsorbed and difficult to lose (Connel, D.W., G.J. dan Miller Kimia, 1995). Pesticides tend to be absorbed by the soil will soon be absorbed by the plant, so that the pesticide content in plant products will be higher.

Observing how farmers use pesticides and how to mix two, or even three more types of pesticides, these need serious attention from the government. It is found in the field that farmers mix the pesticides based on mere feeling, based on average measurement without a definite size. They use big drums to mix. Pesticide materials can be two, three and even four, depending on the mixing results and their experience of controlling plant pests and diseases. They are also accustomed that after spraying, they are smoking instantly. Mixing some pesticides in drums, mixed by sticks or wood without wearing gloves, they use their hands that are also wet because of pesticides. Pesticide packs are also thrown away indiscriminately mixed with other garbage or thrown indiscriminately in the fields. The direction of spraying is sometimes against the coming of the wind as they spray following the flow of the trench.

With undetected results it becomes a big question mark whether the existence pesticide contains the proper active ingredients material as they appear on the label or are they less. If less means there is no match between the doses with the existing rules. Therefore, we need to analyze the content of active ingredients from pesticides used. This becomes important if the existing pesticides are false which is clearly detrimental against the farmers. Thus, a more detailed study of the content of pesticides, especially the active ingredients for future research, should be done. The government should also monitor the presence of pesticides. However, if the pesticide is genuine means that there is an indication of the immunity of pest being sprayed, the used of other pesticides should be considered. Or it could be happened because of the mixing of several types of pesticides which pursuant to the expectation of farmers, it may increase the power of pesticide efficacy, however it is not. It could be that two or three types of pesticides that are mixed have no synergistic power but are antagonistic. It means that they weaken each other instead of strengthening. Thus, the objective of farmers to increase the efficacy of pesticides is weakening.

Conclusion:

Based on the result of the research, it was found that the residue compound that was detected only the profenofos concentration in chili vegetables that is above the maximum limit of residuals determined by the Indonesian National Standard in 2015, namely 3.0 mg/kg. The concentration of profenofos in tomato vegetables is still below the maximum limit of residuals of the Indonesian National Standard that is 2.0 mg/kg but has passed the RfD US-EPA standard in 2006 that is 0.00005 mg/kg /day. Carrots, tomatoes, potatoes and cabbages vegetables are not detected with residues group of organophosphates. Pesticide residue test of soil and water samples was not detected with any residues of pesticide group of organophosphates. Pesticide residues in the sample on the farmland cannot be compared with the established quality standard. The requirement for further study on the impact of the use of insoluble pesticides and high persistency in agricultural land in Cikajang region, Regency of Garut needs to be done in order to understand the magnitude of biomarker impact of the use of pesticides. Pesticide residues in vegetable products, mainly is due to the excessive use of pesticides during production processes in terms of type, composition, dose, time, and interval (E Suryaningsih, 2008). Farmers' perception of pest attack as the main cause of crop failure has encouraged excessive use of pesticides. To inform that the preventive control is carried out by about 80% of vegetable farmers by spraying pesticides 1-7 days after planting in the field (Tonny, K., 2014). The absence of residuals in water and soil may be caused by the different distribution and residual content in the soil that depends on many factors, such as the behavior of farmers in using pesticide content of active ingredients, so it is necessary to test the authenticity content of pesticide content in the region of Garut, in general.

Suggestion:

It is advisable to examine the residual content of pesticides at the merchant level and consumer level after washing the vegetables so that the content of the remaining pesticides can be compared as well as their consumption patterns. It is advisable to compare the content of the authenticity of the active ingredients in the remaining pesticide. It is advisable as well to check the residual content of pesticide group of organoclorin. It is needed the role of government in counseling and guidance of the use of pesticides in good and in correct method.

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