

The Effect of Pesticide Usage towards the Environmental Damage in Sungai Lintang Village West Kayu Aro Sub-district Kerinci Regency

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Abstract – According to the preliminary survey that has been conducted in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency, farmers do not use pesticide as follows in the pesticide tag / packaging, so it is estimated to be happened of residual disposition in the soil and will affect the environment. The aim of this research is (1) To find out whether there are pesticide residue in the soil or not due to the pesticide usage on plants (2) To describe how is the effect of pesticide usage on soil damage in the agricultural land (3) To describe how is the effect of pesticide usage on deterioration on farmers' life quality. (4) To describe is the effect of pesticide usage on agricultural output and income. This research used quantitative approach and descriptive research type. This research worked with three hypotheses: (1) There is a significant effect between pesticide usage with the soil damage on agricultural land, (2) There is a significant effect between pesticide usage with Farmers' Life Quality, and (3) There is a significant effect between pesticide usage with agricultural output and income on Sungai Lintang Village West Kayu Aro Sub-district Kerinci Regency. According to the data analysis, it is found that there are pesticide residues in one of the soil samples which the residual rate is 0,16 mg/kg over the limit of 0,005 mg/kg. According to the correlation test analysis result, There is a negative (-0,707) and significant (0,000) effect between pesticide usage (X) to the soil damage on agricultural land (Y1), There is a negative (-0,518) and significant (0,001) effect between pesticide usage (X) to the farmers' life quality; (Y2), and There is a positive (0,642) and significant (0,000) effect between pesticide usage (X) to the agricultural output and income (Y3). According to the research result, it is concluded that inappropriate pesticide usage are going to effect the environment, even it is on the soil, income or health.

Keywords – Environment Damage, Pesticide.

I. INTRODUCTION

The deterioration in the environment quality has threatened the survival of human beings and other living things. One cause that decrease the environmental quality is the use of chemical-based products, one side has produced products that are beneficial to the community and on the contrary it has negative impacts of hazardous and toxic waste that can affect the environment quality. (Edial, Muchtan, & Dewata, 2019) Environment Damage consists of natural and social factors. Natural is soil damage, while

social is farmers' life quality deterioration, and farmers' agricultural output and income. (Kutanegara, 2004).

The use of pesticides as a production factor has proven that pesticides can quickly reduce **pest** populations until attacks can be prevented, and crop losses can be reduced (Sulistiyono, Tarumingkeng, & Sanim, 2008). The highest and most intensive pesticide usage in agricultural activities is the type of vegetable and secondary crop cultivation activities (Abadi et.al, 1993 in Rario, 2004). Horticulture is the cultivation of vegetables, fruits, and various ornamental plants, horticulture now becomes a profitable commodity

due to the increasing economic growth which affect the community's income to be increased (Zulkarnain,2009). One of the horticultural crops that use quite intensive pesticide is Horticultural Crops which are of the Vegetable (Olericulture) type. It is the horticulture in Kerinci Regency, which specifically located in Sungai Lintang Village, West Kayu Aro Sub-district.

Sungai Lintang Village is one of the areas which is the centre of Horticultural Crops production in Kerinci Regency, this matter can be seen by the harvested area, production and productivity of Horticultural Crops which fluctuates annually (Dinas Pertanian Kerinci, 2014). Horticultural Crops production area in Sungai Lintang Village which located in West Kayu Aro Sub-district is a agricultural centre in Kerinci Regency due to the geographic and climate condition which is very potential to be developed as agricultural area. The amount of Horticultural Crops production in 2018 at Sungai Lintang Village is 2760 tons (BPS of Kerinci Regency, 2019).

The area of Sungai Lintang Village is in the highland around the foot of Mount Kerinci. Agro-climate conditions of this area are suitable for planting a variety of horticultural crops, such as potatoes, chilies, tomatoes, cabbage. The area of agricultural land used for agriculture is 1800 ha, where for food crops 2 ha, plantations 3 ha, and horticultural crops 1,768 ha. According to those data, it is known that Sungai Lintang Village in West Kayu Aro Sub-district is one of the agricultural centres of Horticultural Crops that is large in Kerinci Regency.

Based on preliminary observations conducted in sungai lintang village, The farmers spray the Horticultural crops with spraying intensity which is 2 times a week, in the morning and night, so in **one** planting season is estimated to reach 12 - 20 spraying times. So that it is thought to cause residuals in the soil and will affect some changes in soil properties in the physical, chemical and biological soil properties. Besides, the farmers in sungai lintang village also use the same type of pesticide for spraying various horticultural crops, farmers do not use pesticides according to the needs of these crops, so it can be suspected that the pesticide deposition in the soil is caused by the inappropriate pesticide usage.

According to the description above, the researcher sees that it needs to be conducted a research about the environmental study entitled "The Effect of Pesticide Usage on the Environment Damage in Sungai Lintang Village, West Kayu Aro Sub-district Kerinci Regency".

Research Objectives:

1. To find out whether there are pesticide residues in the soil or not due to the pesticide usage on Holticultural Crops in Sungai Lintang Village West Kayu Aro Sub-district Kerinci Regency.
2. To describe how is the effect of pesticide usage on soil damage in agricultural land of Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.
3. To describe how is the effect of pesticide usage on the deterioration of farmers' life quality in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.
4. To describe how is the effect of pesticide usage to the farmers' agricultural output and income in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.

II. METHOD

This research used quantitative approach with the type of description research. Population in this research was the whole agricultural land of horticultural crops and farmers in Sungai Lintang Village, West Kayu aro Sub-district, Kerinci Regency. Soil samples are obtained based on the slope of the land while respondents' samples are fixed based on the formula:

$$\frac{N}{N(e)^2 + 1}$$

Information:

n = number of samples

N = total population

e = 15% error limit

1 = constant number

Soil samples for horticultural crops were taken 1 sample for each sub-village, in Sungai Lintang village there were 3 sub-villages, so there were 3 lands that would be taken as soil samples in horticultural crops. While the sample of respondents was 39 respondents. The samples were obtained from sungai lintang Village, West Kayu aro Sub-district, Kerinci Regency.

The instrument used in this study was a laboratory test conducted at the Pesticide Laboratory for the Protection of Food and Horticultural Crops Centers in West Sumatra, and questionnaires to be given to respondents in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.

Laboratory tests were conducted using a Gas Chromatography (GC). The detected residues were

pesticides which were Organophosphate group, with the type of insecticide, and were made from Profenofos and Chloririphos.

Independent variable (Free) in this research was pesticide usage symbolized by X, while the dependent variable (Controlled) in this research was soil damage (Y_1), farmers' life quality (Y_2), farmers' agricultural output and income (Y_3).

The analysis to find out the relation between Variable X and Variable Y was conducted Correlation Test Analysis with the symbol "r" as follows:

$$r_{xy} = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}$$

Information:

r_{xy} = Correlation coefficient sought

$\sum xy$ = Number of times the product of x and y

$\sum x^2$ = The sum of the squares of the difference between the X values

$\sum y^2$ = The sum of the squares of the difference in the value of Y

The requirement test was conducted before conducting analysis of Laboratory and Correlation Test result. Laboratory Test was conducted by the requirements consisted of Linearity Test, Limit of Detection (LOD), Limit Of Quantification (LOQ), Accuracy (Provision), Precision. While the test requirements of Correlation Tests consisted of: Homogeneity Test, Normality Test, Linearity Test.

III. RESULT AND DISCUSSION

Pesticide Residues Rate Test

Pesticide residues in agricultural land in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency is tested with laboratory test using gas chromatography then the gas chromatography test result is used to calculate the amount of residual rate in the soil. The results of residual rates from the three samples are as follows:

Pesticide	Samples	Residual Content
Profenofos	A	Not detected
	B	0,16 mg/kg
	C	Not detected
Chlorpyrifos	A	Not detected
	B	Not detected
	C	Not detected

From the table above it can be explained that there is only one type of sample that contains pesticide residue rate, which is profenofos in sample B which residual content is 0,16 mg/kg, other than that there are no pesticide residues profenofos or chlorpyrifos rates in other types of soil samples. Profenofos pesticide residue rates found in sample B which has residual rates of 0,16 mg/kg is considered as high residual rate where the profenofos pesticide residue rates provision is 0,005 mg/kg.

Correlation Test

Hypotheses Test:

1. H_0 = Pesticide usage has no significant effect towards the soil damage in agricultural land of Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency
 H_1 = Pesticide usage has a significant effect towards the soil damage in agricultural land of Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.
2. H_0 = Pesticide usage has no significant effect towards the Farmers' Life Quality in Sungai Lintang

Village, West Kayu Aro Sub-district, Kerinci Regency

H_1 = Pesticide usage has a significant effect towards the Farmers' Life Quality in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.

3. H_0 = Pesticide usage has no significant effect towards the Farmers' Agricultural Output and Income in

Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency

H_1 = Pesticide usage has a significant effect towards the Farmers' Agricultural Output and Income in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency.

Correlations					
		Soil Damage (Y1)	Life Quality (Y2)	Agriculture Result and Income (Y3)	Pesticide Usage (X)
Soil Damage (Y1)	Pearson Correlation	1	.493**	-.395*	-.707**
	Sig. (2-tailed)		.001	.013	.000
	N	39	39	39	39
Life Quality (Y2)	Pearson Correlation	.493**	1	-.255	-.518**
	Sig. (2-tailed)	.001		.117	.001
	N	39	39	39	39
Agriculture Result and Income (Y3)	Pearson Correlation	-.395*	-.255	1	.642**
	Sig. (2-tailed)	.013	.117		.000
	N	39	39	39	39
Pesticide Usage (X)	Pearson Correlation	-.707**	-.518**	.642**	1
	Sig. (2-tailed)	.000	.001	.000	
	N	39	39	39	39
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

The hypothesis test is conducted by comparing the value of product moment correlation analysis (r) with the error.

If $r_{\text{calculation}} > r_{\text{table}}$, then H_0 is rejected

If $r_{\text{calculation}} < r_{\text{table}}$, then H_0 is accepted

With a confidence level of 0.01 (1%), a value of $r_{\text{calculation}}$ for the pesticide usage towards soil damage – 0,707. Because $r_{\text{calculation}} (0,707) > r_{\text{table}} (0,3978)$, then H_0 is rejected, H_1 is accepted and the correlation value is negative. Which means the pesticide usage is effected significantly negative towards soil damage in the agricultural land in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency. The higher the pesticide usage, the soil damage will also be more severe. According to the correlation value obtained, 0,707 are considered in the high correlation levels between variable X toward variable Y1.

The value of $r_{\text{calculation}}$ for Pesticide Usage towards the Farmers' Life Quality is – 0,518. Because $r_{\text{calculation}} (0,518) > r_{\text{table}} (0,3978)$, then H_0 is rejected, H_1 is accepted and the correlation value is negative. Which means the Pesticide usage is effected significantly negative toward the Farmers' Life Quality on the agricultural land of Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency. The higher the pesticide usage, the farmers' life quality will also deteriorate. According to the correlation value obtained, 0,518 are considered as medium correlation level between variable X towards variable Y2.

The value of $r_{\text{calculation}}$ for Pesticide Usage towards Farmers' Agricultural Output and Income is 0,642. Because $r_{\text{calculation}} (0,642) > r_{\text{table}} (0,3978)$, then H_0 is rejected, H_1 is accepted and the correlation value is positive. Which means the Pesticide usage is affected significantly positive towards Farmers' Agricultural Output and Income on the agricultural

land in Sungai Lintang Village, West Kayu Aro Sub-district, Kerinci Regency. The higher the pesticide usage, Farmers' Agricultural Output and Income will also increase. According to the correlation value obtained, 0,642 are considered as medium correlation level between variable X towards variable Y3.

IV. CONCLUSION

1. Laboratory test is conducted by gas chromatography showed that one sample contained pesticide residue rate with active profenofos as much as 0,16 mg/kg which is considered as high when compared to the determination limit of 0,005 mg/kg. For some other samples, there are no active profenofos or chlorpyrifos pesticide residues.
2. There is a negative (-0,707) and significant (0,000) effect between pesticide usage (X) towards soil damage on agricultural land (Y1) in Sungai Lintang Village West Kayu Aro sub-district Kerinci Regency.
3. There is a negative (-0,518) and significant (0,001) effect between pesticide usage (X) towards farmers' life quality (Y2) in Sungai Lintang Village West Kayu Aro Sub-district Kerinci Regency.
4. There is a positive (0,642) and significant (0,000) effect between pesticide usage (X) to the agricultural output and income (Y3) in Sungai Lintang Village West Kayu Aro Sub-district Kerinci Regency.

Implication

1. The effect of environment damage is not solely effected by the inappropriate pesticide usage, but there are still many internal and other external factors that can affect environment damage. In this connection, it is necessary to further investigate other factors that are suspected to also affect environment damage.
2. The inappropriate pesticide usage due to the lack of farmer's knowledge about the proper procedures in the pesticide usage. In addition, agricultural counselor is also very rarely come to do counseling, so farmers lack the latest information on how to use pesticides properly. To minimize the impact, it needs to follow up on this matter, such as counseling as often as possible.

Suggestion

1. The results of this research are expected to become the reference of the research in the future.

2. For the farmers of horticultural plants in Sungai Lintang Village, West Kayu Aro, Kerinci Regency are expected to use pesticide in accordance with the determined standard and dose.
3. Further research about pesticide residual beside profenofos and chlorpyrifos active material is necessary to be conducted either towards the soil or fruits and vegetables at the horticulture agriculture land of West Kayu Aro District, Kerinci Regency, as the comparison material and information to enrich the scientific study about the status of damage soil in larger area in West Kayu Aro District.

REFERENCES

- [1] Badan Pusat Statistik, 2019. Kabupaten Kerinci.
- [2] Dinas Pertanian Kabupaten Kerinci, 2019. Kabupaten Kerinci.
- [3] Edial, H., Muctar B., & Dewata, I. (2019). Evaluation Of Land Use to Critican Batang Kuranji Watershed in Padang City. IOP Conference Series : Earth and Environmental Science, 314, 012004.
- [4] Rario, Budi. 2004. Kajian Persepsi dan Perilaku Petani terhadap Resiko Penanganan Residu Pestisida di Lingkungan. Tesis. Magister Pengelolaan Lingkungan. Universitas Gadjah Mada: Yogyakarta.
- [5] Sulistiyono, dkk.2008. Pengetahuan Sikap dan Tindakan Petani Bawang Merah dalam Penggunaan Pestisida, Jawa Timur.
- [6] Zulkarnain, (2009). Dasar-Dasar Hortikultura, Jakarta : Bumi Aksara.