PAPER • **OPEN ACCESS**

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To cite this article: Suyud Warno Utomo *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **314** 012033

Relationship of determination pesticide doses with horticultural farmers health complaints in Cikajang, Garut

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Abstract. The role of pesticides in agriculture is crucial. Pesticides are needed to protect plants from pests and plant diseases. The opinions among farmers about more doses of pesticides used in plants will be more effective in protecting plants. The pesticides use that do not comply with the rules of use indirectly cause health complaints. This study aims to identify the correlation between the behaviour of farmers in determining the dose of pesticides with health complaints caused to farmers in Cikajang District, Garut Regency. This study uses primary data with 105 subjects and also sprayed plants using pesticides. The study design was cross sectional and the data were analysed bivariately with chi-square. This study there was no significant correlation between the behaviour of farmers to determine the dose of pesticides with health complaints that occurred (P = 0.079 with OR = 2.053 95% CI 0.936 - 4.502). Farmers behaviour in determining the dosage of pesticides to be applied in plants is not related to health complaints that occur in farmers. This is probably caused by other factors that affect health complaints.

1. Introduction

Most farmers still consider the purpose of using pesticides merely to control and eradicate animals that are risk to the plants. Whereas the understanding of pesticides is a chemical substance used to control and expel plant-disturbing animals and diseases that attack agricultural crops [1]. The use of pesticides is influenced by two important factors, namely the size of the dose and the concentration of pesticides used on agricultural land [2]. There are six principles that must be applied in the use of pesticides by farmers, including on target, right quality, right type, timely use, right dose of use, and appropriate method of use [3]. If these six principles can be applied by farmers and other pesticide users, the effectiveness of the pesticide's active energy and active ingredients can be felt.

Cikajang District, Garut Regency, is one of the areas with the largest agricultural centers in West Java Province. The area of Cikajang Subdistrict reaches 12.790,78 hectare and 46.48% of the total area is agricultural land. Agricultural crops that are commodities in the region are cultivated vegetables or better known as horticulture. Horticultural plants are divided into four types, namely based on the stature of plants, plants that can shed leaves, plant life cycle, and plant use. While vegetable commodities which are among the top three are in Cikajang District, including potatoes 1.442-hectare, cabbage 1.033 hectare, and chili 548 hectare [4]. All of the plants must require pesticides for protection of pests.

Based on research conducted by [5] the behavior of farmers in using pesticides is still classified as poor (63%) and causes health problems. Percentage of poor behavior of farmers in pesticide use is shown

by the large percentage of farmers who did not read the rules of use first when using pesticides, which is 47.26% and 61.81% of respondents used pesticides not according the rules stated on the pesticide packaging label [6]. Farmers used pesticides in plants based on the situation and condition of the garden on the day their plant. If the weather conditions are dry, spraying plants using pesticides is done every three days or even once a week, but if it is found wet, humid, and rainy, spraying pesticides is done every two days. This is done based on the pesticide grain will be carried by the rain and cannot stick to the plant when exposed to rainwater. Farmers in determining the dose of pesticides are also based on the many pests found in the garden. If the number of pests is increasing and the risk of causing financial losses, the farmer will quickly increase the dose of pesticide used so that the pest can die in the opposite direction. If a little pest is seen by the eyes of farmers, then the dose of pesticide is reduced or not sprayed by farmers waiting for pests in amounts that are at risk of causing financial losses.

The farmers behavior who are less concerned with pesticide doses to protect plants will have an impact on various types of agricultural problems. According to Adriyani [7] there are seven negative impacts of pesticide use that are not in accordance with the usage rules, such as causing water pollution, agricultural soil pollution, air pollution, causing resistant pest species, causing secondary pest explosion, resurgence, damage ecosystem balance, and causing health problems for humans. The discovery of pest resistance due to excessive use of pesticides was found in Bogor, West Java, with *Helopeltis antonii* pests in cocoa plants [6]. Based on several studies that have been conducted, the negative impact of the use of pesticides on human health can be form of symptoms of poisoning and chronic health problems. Symptoms of pesticide poisoning, for example epileptic seizures, nausea, vomiting, headache, anxiety, tremor, loss of consciousness, ventricular fibrillation, and respiratory depression. Then, chronic health problems, such as disorders of the human nervous system and inhibition of cholinesterase enzymes that play a role in the body's metabolic system.

Bad behavior of farmers determines that the dosage of pesticides is not in accordance with the rules and health complaints that arise need to be carried out further research. So, based on the description, this research was conducted to find out the relationship between the behavior of farmers in determining the doses of pesticides in plants with the emergence of health complaints.

2. Method

This study uses a cross sectional study design with independent variables behavior of farmers determine the dose of pesticides for plants and the dependent variable health complaints experienced by farmers after using pesticides. The location of this study is in Cikajang District, Garut Regency. Determination of the number of samples in this study using the proportion estimation formula. The value of CI used is 95% and the deviation value is 10%. As well as the estimated proportion value using the results of BPS data from Garut Regency at 38.18%. The formula for estimating the proportion equation used is as follows:

$$\mathrm{n} = \frac{Za^2 p\,(1-p)}{a^2} \tag{1}$$

Information:
n : size of sample
Za : confidence interval (CI 95%)
P : estimated proportion
d : deviation (10%)

The results of this equation obtained a sample size of 91 respondents, to avoid the dropout of respondents the results were added 10% of the total sample so that the total sample was 105 respondents. Respondents are people who live in Cikajang District who work as farmers or farm laborers and usually spray plants using pesticides. The selection of respondents uses purposive sampling method in each village located in Cikajang District.

In this study univariate and bivariate analyzes were conducted. Univariate analysis was carried out by means of frequency analysis to see the number of farmers who determined the dosage of pesticides for plants according to the rules and not according to the rules and to know the number of farmers who

experienced health complaints while using pesticides for plants. Bivariate analysis is done by means of kai squared test by considering the p value and the magnitude of Odds Ratio (OR) resulting from cross tabulation calculations between these variables.

3. Result

Based on interviews, the number of farmers who have good and bad knowledge can be seen in Table 1, as follows:

Table 1. Distribution of Farmer's Behavior in Using Pesticide on Plants

No.	Category	Frequency (Respondent)	Percentage (%)
1	Good	39	37.1
2	Less Good	66	62.9
	Total	105	100

Table 1 shows that more than half (62.9%) of respondents had bad behavior in using pesticides for plants while farmers who had good behavior were 37.1%. The results of the analysis of the behavior of farmers in using pesticides in Table 1 are directly proportional to the percentage of the number of farmers who determine the dose of pesticides for plants not in accordance with the rules of use. These results can be seen in Figure 1, as follows:

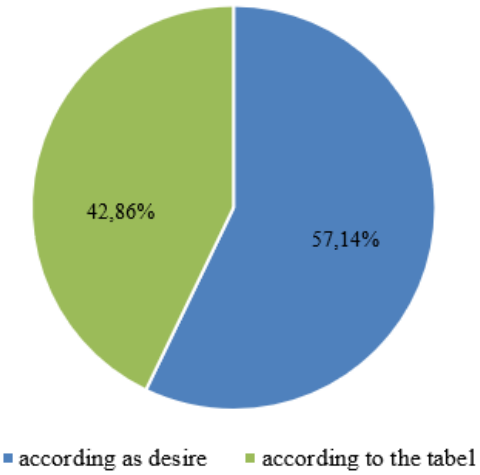

Figure 1. Determine of pesticide doses

Diagram in figure 1 shows that 57.14% of farmers determine the dosage of pesticides is not in accordance with the rules, while 42.86% of farmers determine the dose of pesticides in accordance with the rules contained in the packaging label of pesticide products.

More than 50% of farmers said that they experienced health complaints experienced by farmers while using pesticides for plants. The following are the results of the analysis of the number of farmers who experience health complaints and types of health complaints that are often experienced by farmers.

Table 2. Number of Farmers Who Experience Varied Health Complaints

No.	Health Complaints	Frequency	%
1	Itchy	7	6.67
2	Poignant eyes	5	4.76
3	Limp body	1	0.95
4	Blurred vision	1	0.95
5	Nausea and dizziness	39	37.14
6	Shortness in the chest	2	1.90
7	Do not experience	50	47.62

Table 2 shows that there were 7 (6.67%) respondents of itching on the skin, as many as 5 (4.76%) eye respondents were irritable, 1 (0.95%) respondents felt weak and blurred, as much as 2 (1.9%) respondents experienced tightness in the chest, and health complaints most experienced by respondents were nausea and dizziness as many as 39 (37.14%) respondents. While as many as 50 (47.62%) respondents did not experience health complaints.

The square test of the behavior variables of farmers determining the dose of pesticides with health complaints experienced by farmers while using pesticides can be seen in Table 3, as follows:

Table 3. Results of Chi-Square Analysis Determining Pesticide Doses and Health Complaints

			Health Complaints		Total	P value	OR (95% CI)
			No complaints	There are complaints			
Determination dosage of pesticides	As per Label	n	26	19	45	0,079	2,053 (0,936-4,502)
		%	52.0%	34.5%	42.9%		
	Not Based on Label	n	24	36	60		
		%	48.0%	65.5%	57.1%		
Total		n	50	55	105		
		%	100.0%	100.0%	100.0%		

Based on Table 3 it is known that there are 65.5% of respondents determine the dose of pesticides for plants that do not fit the label and experience health complaints. Whereas the respondent who determined the dose of pesticide for the plant according to the label and experienced health complaints was 34.5%. P value of 0.079 means there is no significant relationship between the behavior of farmers to determine the dose of pesticides with health complaints experienced by farmers while using pesticides on plants. OR value of 2.053 means that farmers who determine the dose of pesticide in plants that do not fit the label 2.053 times the risk of experiencing health complaints compared to farmers who determine the dose of pesticides in plants according to the table.

4. Discussion

Most (62.9%) farmers have poor behavior in the use of pesticides. The results of farmer behavior analysis were obtained from interviews with farmers using a questionnaire with five questions. Among the behaviors of farmers reading the label first before using pesticides, farmers use personal protective equipment when mixing pesticides before spraying on crops, farmers re-examine the packaging of pesticide products before reuse, farmers pay attention to the direction of the wind when spraying plants using pesticides, and farmers save pesticide products in a special room. Of all the questions, the behavior of farmers to re-examine pesticides before being reused obtained results that did not re-examine the most compared to the number of farmers who re-examined pesticides. The things that are examined are the state of pesticide formulations and instructions for use on the label of pesticide products. Based on the results of an interview with a head of the Girijaya Village farmer group in Cikajang District, things that need to be re-examined when they want to use pesticides such as the state of pesticide formulations have changed color and shape or not, and the quantity of pesticide formulations remaining to be used so that farmers do not need to make sense so that you can still use it.

The reason the farmers stated that they did not re-examine the pesticides when they wanted to use it again, they felt that they had understood the method and formulation of the pesticide. In fact, according to the results of observations and targeted interviews, most of the ways farmers determine the dose of pesticides in plants by using the principles of weather forecasts and the number of pests contained in plants in other words farmers determine the dose of pesticide use according to their feelings. And many of the farmers claimed to have obtained a way to determine the dosage and mixing pesticides on the plants from fellow farmers and personal experiences in the field where the information is chain-based to previous peers without any reference material as a source that can be accounted for.

Whereas the definition of the dosage in question is the number of pesticides in liters or kilograms that are used to control pests per certain area or each plant that is carried out in one application or more. Usually a large dose of a pesticide is listed on the label of a pesticide product, not derived from the mere estimates and feelings of the farmer [2]. This condition is illustrated in the analysis results of Diagram 1 which states that there are 57.14% of respondents determine that the dosage of pesticides does not match the label. Determination of pesticide doses that do not match the usage label by farmers sometimes during rainy weather and many pest conditions on plants, they increase the dosage according to the efficacy of pesticides in disabling plant pest pests. These results are in accordance with the research of [8, 9] that to reduce the risk of farmers production routinely and intensively spraying pesticides with very high frequency of spraying, even most farmers spray pesticides without taking into account the presence or absence pest attack. The results of other studies conducted by Basuki [10] state that the majority of farmers in Brebes and Cirebon spray insecticide regularly and intensively, with high doses and short duration of spraying with one another to prevent pests from developing worse.

Negative impacts can occur, one of which is the high level of pesticide residues found in plants. Factors that influence the high levels of pesticide residues in plants, including the types of pesticides used, such as the easy or difficult pesticide active ingredients dissolved in water, the large dose of pesticides when applied to plants, and the timing of the application of pesticides to plants [11].

Based on Table 2 about health complaints experienced by farmers due to the use of pesticides it is known that most respondents experienced complaints of nausea and headache as many as 39 (37.14%) respondents and 7 (6.67%) respondents experienced skin irritation in the form of hives due to exposure to liquid pesticides after spraying. And there were also respondents who experienced symptoms of severe poisoning, namely asphyxiation as much as 2 respondents and blurred vision by 1 respondent.

Health complaints that occur to farmers are the initial symptoms of poisoning that occur within 6-12 hours after exposure. The use of organophosphate, organochlorine and carbamate pesticides is the main cause of the initial symptoms of poisoning [12,13]. The initial symptoms of poisoning include irritation of the skin, nausea, vomiting, weakness, headaches, and health problems. While health complaints in the form of shortness of breath experienced by 2 respondents are a continuation of the same type of pesticide [14].

The initial symptoms of poisoning that occur due to various kinds of factors that influence [3], such as the physical condition of farmers who are less healthy at the time of spraying, not breakfast at the time of spraying, not using PPE recommended for spraying pesticides, especially masks, gloves, and closed clothes. Farmers who do not pay attention to the direction of wind gusts can also cause the mixture of pesticides as well as the behavior of farmers when spraying, such as smoking, scratching the body, rubbing the eyes, and not cleaning the limbs after spraying plants [2].

Pesticide residues that are swallowed into the human body and then deposited with fat tissue in the body can disrupt the process of metabolism in the human body. For example, exposure to organochlorine pesticides against the human body. Organochlorine stimulates the nervous system and causes paresthesia, is sensitive to stimulation, irritability, disruption of balance, tremor and convulsions. Several chemicals including the organochlorine group induce facilitation and hyperexcitation in synapse links and neuromuscular linkages that result in repeated disarmament in central neurons, sensory neurons, and motor neurons. Organophosphates and carbamates inhibit AChE. The functions of acetylcholinesterase (AChE) include hydrolysis of acetylcholine (ACh), inhibited the neurotransmitter can be increased in number and function [15]. The availability of ACH in the brain causes neurons to be easily transported and improve cognitive function of the brain. If AChE is interrupted, it will cause a disturbance in the central nervous system that affects the nervous system failure of the human. Continuous exposure in a long duration will cause health problems that are acute and chronic and lead to death.

The results of the kai squared analysis on the determination of pesticide doses with health complaints stated that there was no significant relationship ($p = 0.079$) between farmers who determined pesticide doses according to the label and did not match the label. While the OR value of 2.053 means that farmers who determine the dosage do not match the label of 2,053 times the risk of experiencing health

complaints compared to farmers who determine the dose of pesticide according to the label. The statement that there is no significant relationship between farmers who determine the dosage of pesticides according to the label and does not match the label for health complaints experienced by farmers is predicted to have other factors that affect health problems that occur to farmers, such as the psychological level of farmers affected by various kinds of social, economic, educational and political fields of life. As well as predicted food intake factors received by respondents who were not examined in this study. Although there is no significant relationship, a persuasive and preventive approach is needed so that poor behavior in determining the dose of pesticides in plants does not cause wider environmental and health problems.

5. Conclusion and Suggestion

Based on the results of the study there is no significant relationship between the behavior of farmers who determine the dose of pesticides in plants with health complaints experienced by farmers but still at risk of causing health problems twice as much as farmers who determine the dose of pesticides is not in accordance with the label. Communication, information and education needs to be carried out by the Cikajang District Agriculture Office in collaboration with farmer groups in each village about the use of good and correct pesticides in order to protect farmers from acute and chronic health problems.

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