Pesticides Usage in Vegetable Farmers in South Sulawesi

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Abstract. This study describes the relationship among personal factors, knowledge of the use of pesticides and the farmers' behavior in utilizing pesticides. The study sample was 100 vegetable farmers in Gowa District and Enrekang District in South Sulawesi. Personal factor variables are education, age and land ownership status. Data obtained by giving questionnaires to respondents. The results showed that the personal factors of farmers did not affect the knowledge and behavior of pesticide utilization. Furthermore, farmers' knowledge also has no effect on the behavior of pesticide utilization.

Keywords: behavior, knowledge, personal factor

1. Introduction

Indonesia with a wealth of land resources is also supported by the ability of farmers in land management. In this effort, farmers in Indonesia generally use pesticides to control various agricultural pests. Globally, chemical pesticides were used 50 years ago. The industrial product is used by farmers around the world [1]. In the sustainable agriculture concept, pesticide usage is the last alternative because it impacts on land quality and human health. However, practically in the field farmers, generally use pesticides due to the benefits of harvest production that farmers feel. Globally, the use of pesticides around the world is growing due to the wider trade in chemicals. The types of chemical pesticides commonly used are herbicides and insecticides [2].

Various forms of pesticides can be found in Indonesian trade. Pesticide usage adjusts to the target body to be controlled. Types of pesticides Akarisida is used to kill fleas or mites. Alvisides are used by farmers to kill birds. There are also types of pesticide to kill fungi or fungicides. Farmers in Indonesia generally use herbicide-type pesticides (to kill grass), insecticides (kill insects) and rodenticides (to kill rats). The pesticide usage is also diverse, some of which are in the form of flour, liquid, oil, and aerosols. Pesticides in the form of flour are first dissolved in water and then sprayed with a sprayer or to soak the seeds. There are also farmers who use pesticides with emulsifiers which can be used after dissolving in water. Its usage is also with a sprayer.
At this time, pesticides are used as the main ingredient in pest control efforts. This is because farmers do not know other techniques [3]. In addition, disproportionate pesticides usage such as the use of doses in the event of a pest attack or farmers more often use these chemicals during the rainy season. What more worrying is that farmers do not care about the dangers of pesticides that can poison farmers, their families, and their environment.

Another impact with pesticide usage is the pollution of water, soil, and air that can disrupt the balance of the ecosystem. This is caused by the accumulation of chemical residues in the environment. Increasing chemical content is getting worse due to improper usage. Research describes that only about a percent of pesticides are involved at target, and the remaining 80 percent fell to the ground. In addition, various previous studies stated that water pollution due to pesticides from organophosphate groups reduces the diversity of insects in the soil and their population such as Acarina sp. Furthermore, many function microbial as soil microorganisms lost due to exposure to chemicals. Accumulation of pesticide residues in nature is also part of the food chain or poison pesticides contained in human ingredients. As a result, the incidence of cancer and birth defects increases dramatically [4][5].

With these various descriptions, the agricultural system must be supported by efforts to increase awareness of farmers in the proper use of pesticides. This study describes the description of farmers' knowledge and behavior in using pesticides. Further studies on these two variables are outlining the relationship between the personal factors of farmers and the knowledge and behavior of farmers.

2. Research method

This research method is a quantitative survey using a questionnaire instrument. The instrument contains statements that represent variables of knowledge and behavior of farmers. The questionnaire also includes statements about education, age, and land ownership.

| Variable | Indicator | Answer |
|----------|-----------|--------|
| Self-factor | Age | 0 = non-productive age ; 1 = productive age |
| | Education | 0 = low education ; 1 = high education |
| | Owner | 0 = farmer is not the landowner 1 = farmer is the landowner |
| Knowledge of farmer about pesticides | Type of chemical pesticides | 1 = the knowledge about pesticides is very low. |
| | Type of organic pesticides | 2 = the knowledge about pesticides is low. |
| | The dosage of chemical pesticides | 3 = the knowledge about pesticides is high |
| | How to use | 4 = the knowledge about pesticides is very high |
| | Time usage | |
| | Impact of chemical pesticides usage | |
| Using pesticides behavior | Using of pesticides | 1 = behavior pesticide usage is very contradicted sustainable agriculture |
| | Using pesticides on rainy season | 2 = behavior pesticide usage is contradicted sustainable agriculture |
| | Using pesticides on dry season | 3 = behavior pesticide usage support sustainable agriculture |
| | Pesticides election | 4 = behavior pesticide usage is very supported sustainable agriculture |
| | Safeguard utilization | |
| | Pesticide storage | |
| | Waste disposal | |
Research respondents were 100 people representing vegetable farmers in South Sulawesi. Research locations in Gowa Regency and Enrekang Regency as centers for vegetable cultivation. A description of the research variables and indicators is presented in Table 1. Data analysis uses the descriptive method and statistical analysis of the Pearson correlation test to see the effect between variables. This analysis is supported by SPSS Version 22. Descriptive analysis outlines the scores of knowledge variables in two categories, namely values above 0.5 indicating that knowledge is low and a lower score indicates low knowledge of farmer score. Behavioral variables and indicators are categorized into four levels, there are:
- A value of 1.00 - 1.75 shows a very low category
- A value of 1.76 - 2.50 shows a low value
- A value 2.51 - 3.25 shows high scores
- A value of 3.26 - 4.00 shows a very high value

3. Results and discussion

Description of the personal factors of farmers shows the farmers' capacity. Farmers with high education and productive age contribute to their capacity. Likewise, for farmers who own land, they will consider cultivation strategies or techniques that support land productivity. A description of the farmer factors is presented in Table 2.

| Self-factor | Group          | Frequency | Percentage |
|-------------|----------------|-----------|------------|
| Age         | Nonproductive  | 26        | 26         |
|             | Productive     | 74        | 74         |
| Education   | Low            | 32        | 32         |
|             | High           | 68        | 68         |
| Land Owner  | Not landowner  | 46        | 46         |
|             | Landowner      | 54        | 54         |

The results showed that most farmers are in the productive age group (74%). In general, farmers also have higher education or graduate from high school. Furthermore, the distribution of land ownership shows a relatively similar value, namely 54% of respondents are landowners, and 46% are land cultivators.

The description of education and age in Table 2 indicates that farmers have the opportunity to gain additional knowledge. Farmers with productive and highly educated ages are easily given an understanding of appropriate pesticide usage techniques. Descriptive analysis of farmers' knowledge which outlines the score of each indicator is presented in Figure 1.
Figure 1 that the seven indicators reviewed, there is only an indicator with low category while the other six indicators show that the farmers generally use pesticides which are contrary to sustainable farming techniques. The analysis result shows that the farmers use a personal safety device in spraying, but not perfectly.

3.1. Self-factor influence against farmers’ knowledge

Statistic analysis with Pearson correlation test method describing the influence of age, education level and land ownership against the farmer’s knowledge is presented in Table 3.

### Table 3. Pearson correlation test method related to the influence of self-factor against farmers knowledge concerning pesticides

| Hypothesis                                      | Requirement | Analysis Result | Interpretation                                      |
|------------------------------------------------|-------------|-----------------|----------------------------------------------------|
| H₀ = Education affect to farmer's knowledge    | Sig < 0.05  | 0.069           | H₁ = Education do not affect to farmer's knowledge |
| H₁ = Education do not affect to farmer's knowledge | Sig > 0.05  |                 |                                                    |
| H₀ = Age affect to farmer's knowledge          | Sig < 0.05  | 0.045           | H₀ = Age affect to farmer's knowledge               |
| H₁ = Age do not affect to farmer's knowledge   | Sig > 0.05  |                 |                                                    |
| H₀ = owner affect to farmer's knowledge        | Sig < 0.05  | 0.686           | H₁ = Owner do not affect to farmer's knowledge      |
| H₁ = Owner do not affect to farmer's knowledge | Sig > 0.05  |                 |                                                    |

Table 3 shows that of the three self-factor variables, only the farmers’ age affects to their knowledge. Whereas the education and land ownership factors do not affect their knowledge and pesticides usage. Farmers with productive age generally have a high motivation to seek information about the right way for using pesticides. The information is contributed to their knowledge. The more information they get, the more knowledge they have. Low education farmers relatively have the same knowledge as high education farmer. Farming knowledge is obtained farmers’ experiences. The same thing is also illustrated in land ownership influence. Farmers with ownership or cultivator status show high knowledge related to farming.

3.2. Self-factor influence against farmers’ behavior

Farmers’ behavior in using pesticides generally does not support sustainable farming techniques. The behavior of farmers in the use of pesticides, in general, does not support sustainable agricultural techniques. This is shown in the correlation analysis result in Table 4.

### Table 4. Pearson correlation statistic test related to self-factor influence concerning pesticide usage behavior

| Hypothesis                                   | Requirement | Analysis Result | Interpretation                                      |
|----------------------------------------------|-------------|-----------------|----------------------------------------------------|
| H₀ = Age affect to farmer's behavior         | Sig < 0.05  | 0.85            | H₁ = Education do not affect to farmer's knowledge |
| H₁ = Education do not affect to farmer's behavior | Sig > 0.05  |                 |                                                    |
| H₀ = Age affect to farmer's behavior         | Sig < 0.05  | 0.514           | H₁ = Age do not affect to farmer's behavior         |
| H₁ = Age do not affect to farmer's behavior  | Sig > 0.05  |                 |                                                    |
| H₀ = owner affect to farmer's behavior       | Sig < 0.05  | 0.392           | H₁ = Owner do not affect to farmer's knowledge      |
| H₁ = Owner do not affect to farmer's behaviour | Sig > 0.05  |                 |                                                    |
Pearson correlation test result shows that the three self-factor indicators do not affect farmers’ behavior in using pesticides. The test indicates that both high education farmers and low education farmers show farmer behavior that does not support sustainable farming techniques. Similarly, the two personal factors of farmers. Influence of farmers’ knowledge related to pesticides against farmers behavior in using pesticides. The third statistic analysis describes the influence of pesticide knowledge on the behavior (Table 5).

**Table 5.** Pearson correlation statistic test related to the influence of knowledge on pesticide usage behavior

| Hypothesis                                      | Requirement | Analysis Result | Interpretation                        |
|-------------------------------------------------|-------------|-----------------|---------------------------------------|
| H0 = knowledge affect to farmer's behavior      | Sig < 0.05  | 0.85            | H1 = knowledge does not affect to farmer's knowledge |
| H1 = knowledge does not affect to farmer's behavior | Sig > 0.05  |                 |                                       |

Statistic test results in Table 5 shows that farmers’ knowledge does not affect farmers’ behavior. This result is confirmed on a descriptive test that farmers’ generally have high knowledge concerning pesticides. However, sustainable farming behavior related to pesticides is still low. Factually in the field, farmers use pesticides with the aim of high production target. Consideration of using the right dose has not been considered by farmers.

Excessive use of pesticides in agricultural activities due to the increasing number and variety of environmental stresses on land and plants. The pressure causes crop failure or decreased productivity [2]. On the other hand, there is production target pressure with food security reasons. Vegetable farmers in some areas in Indonesia use pesticides as prevention against pest attacks. It is appeared on spraying activity a week after planting vegetables. Spraying frequency is also extremely high and causes high production cost on buying pesticides. Environmental impacts due to the use of pesticides can be controlled by increasing awareness of farmers to use pesticides appropriately. The introduction of vegetable pesticides is highly recommended, and even the basic ingredients are easily found in Indonesia[6].

The results of this study can contribute to the determination of strategies to increase knowledge of vegetable farmers and their behavior that support sustainable agricultural techniques. The community empowerment approaches equally to both landowners and tenants is considered effective. The economic capacity of vegetable farmers will be better by minimizing production costs on the purchase of pesticides.

4. Conclusion
The study of the influence of personal factors on the knowledge of farmers resulted in the age of the farmers influencing the knowledge of farmers. Producers of productive age have better knowledge than farmers with non-productive age. During education and ownership, status does not affect their knowledge. The behavior of farmers in the use of pesticides, in general, does not support sustainable agricultural techniques. The three self-factor indicators do not affect farmers' behavior.

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