The behavior of Pesticide Usage and Risk of Health Disorders in Vegetable Farmers

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Abstract. The study aims to describe the behavior of pesticide usage and its effect on farmer health. Pesticide usage behavior includes indicators of storage behavior and application action. The farmers' health is observed in the activity of cholinesterase blood and the symptoms of the disease. The study has occurred in March-August 2017 involving 60 vegetable farmers in Tinggimoncong District of Gowa Regency, South Sulawesi Province. Blood cholinesterase activity was measured by taking farmers' blood samples. The results showed that farmers showed erroneous behavior in the use of pesticides such as throwing pesticide packaging in an unsafe place and not using the right personal protective equipment. Farmers are at risk for health problems due to mild levels of poisoning.

Keywords: application of pesticides, poison, health risk

1. Introduction
Farming production development in Indonesia is highly related to chemical use such as pesticides and fertilizer. The use of pesticide by the farmer is aimed to control pests, diseases and weeds growth that interfere with the crops grown. The productivity of cultivated crops has risks of pests such as weeds and animal, pests. Pests and plant diseases have implications for a gap between agricultural yield potential and actual yields. Yields lost because of pests and diseases is varied. The previous research revealed that wheat lost production is about 50%, and cotton production is about 80% due to pests and crops diseases [1]. Other studies show that organic farming yield is only around 80% of conventional agriculture. This fact is proof of the low activity of pest and disease control in organic farming [2].

Various forms of pesticides are developed according to the type of organism will be controlled. Insecticides are used for pest control while farmers use herbicides for weed control. Therefore fungicide is the handful for controlling the pathogenic plant fungi; chemical pesticides have a level of resistance in a variety of environments. As a result, the use of this pesticide type leaves a long-term residue and can accumulate in a network through the food chain [3]. This type of pesticide in the organophosphate group has an effective and rapidly degrading effect on the soil. Improper use of pesticides can affect human health. These chemicals are toxic or have toxic powers that can cause direct death in insects, other animals, and even humans. Furthermore, farmer as a main user of pesticides has a big risk of poisoning. The poisoning is usually divided into three level. Namely, mild
acute poisoning, severe acute poisoning, and chronic poisoning. Mild acute poisoning is felt by farmers with symptoms of dizziness, headache, mild skin irritation or diarrhea. Furthermore, farmers who experience nausea, shivering and even stomach cramps usually arise due to severe acute poisoning. The risk that is difficult to detect is chronic poisoning because it does not cause specific symptoms or signs. However, this type of poisoning can cause health problems such as eye and skin irritation, cancer, birth defects or respiratory problems. This study describes the farmers habit in using pesticides, the poisoning level experienced by farmers and the disease they have.

2. Research method
The study method is a quantitative survey of vegetable farmers in Tinggimoncong District of Gowa Regency, South Sulawesi Province. The number of samples is 60 farmers of cabbage and potatoes with the intensity of routine pesticide use. This study uses three types of primary data (Table 1).

| Variable                        | Collecting Data Method                      | Analysis Method       |
|---------------------------------|---------------------------------------------|-----------------------|
| Behavior of Pesticide Usage     | Questionnaire                               | Scoring               |
| Poisoning Level                 | Examination of blood cholinesterase activity | Quantitative/ laboratory examination result |
| Complaint                       | Questionnaire                               | Frequency /Percentage  |

3. Results and discussion
3.1. Respondent characteristic
Respondent characteristics specifically representing vegetable farmers in Tinggimoncong Subdistrict, Gowa District show that farmers generally have high productivity. Table 2 describes the indicators and groups of respondents' characteristics.

| Characteristic                        | Group                              | Frequency | Percentage |
|---------------------------------------|------------------------------------|-----------|------------|
| Age (year)                            |                                    |           |            |
|                                        | 20 - 30                            | 6         | 10.00      |
|                                        | 30 - 40                            | 14        | 23.33      |
|                                        | 40 - 50                            | 33        | 55.00      |
|                                        | > 50                               | 7         | 11.67      |
| Education                             |                                    |           |            |
|                                        | Graduated Elementary School        | 20        | 33.33      |
|                                        | Graduated Junior High School       | 17        | 28.33      |
|                                        | Graduated Senior High School       | 19        | 31.67      |
|                                        | Graduated University               | 4         | 6.67       |
| Kinds of vegetables planted           |                                    |           |            |
|                                        | Cabbage                            | 24        | 40.00      |
|                                        | Cauliflower                        | 22        | 36.67      |
|                                        | Potato                             | 14        | 23.33      |
| Experience as vegetable farmers (year)|                                    |           |            |
|                                        | 0 – 5                              | 12        | 20.00      |
|                                        | 6 – 10                             | 18        | 30.00      |
|                                        | 11 – 15                            | 24        | 40.00      |
|                                        | > 15                               | 6         | 10.00      |
| Land managed area (ha)                |                                    |           |            |
|                                        | 0.00 – 0.25                        | 12        | 20.00      |
|                                        | 0.26 – 0.50                        | 36        | 60.00      |
|                                        | 0.51 – 0.75                        | 8         | 13.33      |
|                                        | 0.76 – 1.00                        | 3         | 5.00       |
|                                        | > 1.00                             | 1         | 1.67       |
Table 2 shows that farmers in general, including workers of productive age, are 78.33% of farmers in the age group of 30-40 years and 40-50 years. Vegetable farmers mostly take formal education at the elementary school level, and there are only 6.67% of farmers who have completed university education. Table 2 also illustrates that farmers cultivate three types of vegetables, namely cabbage, cauliflower, and potatoes. Respondents generally have experience in vegetable cultivation activities.

Description of the respondents’ characteristics shows that respondents are vegetable farmers with more than 10 years of experience as farmers. This shows that the respondent is a professional farmer with a managed area of less than 0.5 ha.

3.2. The behavior of pesticide usage
Vegetable farmers at the study site cultivate plants with conventional farming methods. Intensive use of pesticides at the research site is very clear (Table 3).

Table 3. The use of chemical pesticides

| Pesticide Types | Farmers | | | Sum | Percentage (%) |
|-----------------|---------|-----------------|-----------------|--------|----------------|
|                 | Cabbage | Cauliflower | Potato |       |                |
| 1               | 12      | -             | -      | 12    | 20.00          |
| 2               | -       | 14            | 18     | 32    | 53.33          |
| 3               | -       | 6             | 10     | 16    | 27.00          |

Table 3 shows that there are 53.33% of farmers who use two types of chemical pesticides. There are even 27% of farmers who use three types of chemical pesticides to obtain optimal yields. The results of interviews with researchers concluded that the reason for using two or three types of pesticides at one-time spraying was the risk of large pests and plant diseases, especially in the dry season. Potato plants are at risk of attacking small flies that attack leaves and tubers. In addition, potato plants are also often attacked with caterpillars and lice on the stems and leaves.

In the production target aspect, intensive pesticide use is very encouraging. But in environmental conditions, this practice is not recommended. Excessive pesticide residues on the soil will cause changes in soil chemical balance. Previous studies describe that most farmers around the world are not aware of the risk of health problems due to improper use of pesticides. Farmers generally only wear cotton clothing as protective clothing. This habit can increase the level of absorption of pesticides in the farmer's body. There are even farmers who chew candy or smoke while spraying pesticides [4].

A similar thing was found in this study, the use of pesticides is divided into two parts, namely the storage behavior of pesticides and the spraying of pesticides. The results of the respondents’ answers which were analyzed by scoring method showed that the storage behavior value was 0.37 (Table 4).

Table 4. Scoring analysis of pesticide storage behavior

| Pesticide Storage Behavior | Answer | Sum | Percentage | Scoring of answer |
|----------------------------|--------|-----|------------|------------------|
| 1  Pesticides are stored in tightly closed containers | Yes    | 42  | 70         | 42               |
|                             | No     | 18  | 30         | 0                |
| 2  Pesticide packaging is disposed of in a safe place (planted) | Yes    | 2   | 3.33       | 2                |
|                             | No     | 58  | 96.67      | 0                |

Table 4 shows that farmers keep pesticides in tightly closed packages, but in general, they dispose of packaging in places that are not safe and can contaminate water or soil. A value of 0.37 shows that farmers’ concern for the right storage method is still very low. In the aspect of the behavior of farmers
The analysis result of Juha's research produced a very low score (0.083). This result is the average value on six indicators (Table 5).

| Pesticide use behavior | Answer | Sum | Percentage | Scoring of answer |
|------------------------|--------|-----|------------|-------------------|
| 1 Using waterproof clothing | Yes    | 0   | 0.00       | 0                 |
|                        | No     | 60  | 100.00     | 0                 |
| 2 Using a head protector | Yes    | 2   | 3.33       | 2                 |
|                        | No     | 58  | 96.67      | 0                 |
| 3 Using a mouth and nose protector | Yes | 4 | 6.67 | 4 |
|                               | No     | 56  | 93.33      | 0                 |
| 4 Using a hand protector     | Yes    | 12  | 20.00      | 12                |
|                        | No     | 48  | 80.00      | 0                 |
| 5 Never smoke or chew food when spraying | Yes | 12 | 20.00 | 6 |
|                               | No     | 48  | 80.00      | 0                 |
| 6 Wash the sprayer after use | Yes    | 6   | 10.00      | 6                 |
|                        | No     | 54  | 90.00      | 0                 |

The results of the analysis show that farmers do not wear waterproof clothing when spraying. Similarly, the use of head, mouth, nose, and hands. Even the respondents’ answer about the habit of smoking or chewing food is only 0.10 or the farmers do not pay attention to the risk of entering toxic materials into his body. The habit of washing sprayers is also not considered as an important matter.

Wrong habits in storing and spraying pesticides will have an impact on the health of farmers. The improper use of pesticides causes the risk of farmers’ health problems. Farmers who do not use protective clothing when spraying pesticides can easily experience poisoning. Farmers report symptoms of excessive sweating, itching in the eyes, dry throat / excessive pain or saliva. There are even reports of symptoms of nausea and vomiting [4].

3.3. Impact of pesticide use on farmer health

Chronic residual symptoms of acute pesticide poisoning from organophosphate compounds can include anxiety and depression. In some states, farmers reported higher levels of depression than other population groups. Small work has been done to describe the effects of exposure to organophosphate compounds and symptoms of depression among agricultural populations [5][6]. Analysis examination result of blood cholinesterase activity shows that there are farmers with mild levels of poisoning (Table 6).

| Poisoning Level | Sum | Percentage (%) |
|-----------------|-----|----------------|
| Normal          | 46  | 76.67          |
| Mild            | 14  | 23.33          |
| Heavy           | 0   | 0.00           |
| Sum             | 60  | 100.00         |

The results of this analysis indicate that there are symptoms of mild poisoning among farmers. However, along the level of mild poisoning can cause chronic poisoning. Organophosphate pesticides which are widely used in eradicating pests and plant diseases are considered very effective by farmers. The way these pesticides work as contact poisons, stomach poisons, and respiratory poisons. Poisoning risk to farmers due to the inhalation of toxins in the human body [7]. Cholinesterase enzyme activity is inhibited and causes acetylcholine is not hydrolysed. As a result, poisoning of
organophosphate pesticides can cause neurological disorders. In addition, Pesticide poisoning can have an impact on competition damage. Allergic reactions due to the onset of histamine and serotonin, and even cause the occurrence of more toxic new compounds.

Based on the results of this study, the local government should make a conversion program for farmers against the dangers of pesticides. Knowledge of the right way to use must be owned by farmers. This is part of an environmentally friendly agricultural extension [8]. With this mentoring program, farmers will have a sense of security and avoid the risk of poisoning.

4. Conclusion
The results showed that vegetable farmers at the study site behaved inappropriately in pesticide storage and spraying. Incorrect storage of disposal pesticides packaging, the farmer throw away in an unsafe place. While spraying pesticides behavior, farmers do not use proper personal protective equipment, smoke when spraying and do not wash the sprayers after use. The results of the examination of the level of poisoning by farmers due to pesticides indicate that farmers have a risk of pesticide poisoning in the medium level.

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