PESTICIDE HAZARDS AND SAFE APPLICATION TECHNIQUES FOR FARMERS AND THE ENVIRONMENT IN SUSTAINABLE AGRICULTURE

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Abstract - The unsafe and improper use of pesticides among farmers can pose various health and environmental risks. In order to increase farmers' awareness and understanding of the dangers as well as the safe use of pesticides, a community service program was carried out in Giripurno Village, Bumiaji District, Batu City. This program included socialization and training involving 17 local farmers. The activities covered the delivery of materials on types of pesticides, their negative impacts, and correct and safe application techniques. An evaluation was conducted through pre-tests and post-tests to measure the improvement in participants' knowledge. The results showed a significant increase in farmers' understanding of pesticide hazards and their safe usage. This program is expected to help farmers adopt safer and more sustainable agricultural practices, while also protecting their health and the surrounding environment.

Keywords: *Awarness Campaign*; *Environmental Health*; *Pesticides*;

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1. INTRODUCTION

Batu City is a horticultural area in East Java that produces a variety of agricultural products, including fruits and vegetables [1]. Giripurno Village, located in Bumiaji District, Batu City, is known for its fertile soil, making it a potential agricultural area. The majority of the village's residents work as farmers, relying on agricultural products as their main source of livelihood. Situated on the slopes of Mount Arjuno and Mount Welirang, Giripurno has great potential for horticultural cultivation. Various horticultural crops are cultivated in this area, including kale, cabbage, mushrooms, mustard greens, carrots, bird's eye chilies, red chilies, and potatoes [2]. Farmers rely on pesticides to control pests in their agricultural fields.

Attacks from plant-disturbing organisms such as pests, diseases, and weeds can cause significant losses. Pests are organisms that can damage crops and lead to economic loss [3]. Plant diseases caused by bacteria, viruses, or fungi also have the potential to reduce yields. Weeds compete with main crops for nutrients, water, and light, thereby reducing productivity. Controlling these organisms requires an integrated approach, including the use of pesticides, biopesticides, and good cultivation practices. Regular monitoring and early identification of

pest and disease attacks are crucial to prevent more severe damage. With effective management strategies, losses caused by harmful organisms can be minimized, allowing optimal crop yields.

Pesticides are chemical substances commonly used to control Plant-Disturbing Organisms (OPT) such as fungi, insects, snails, and rodents. According to Law of the Republic of Indonesia No. 22 of 2019, Article 75, pesticides are defined as all chemical substances and other materials, as well as microorganisms and viruses, that can be used to eradicate or prevent pests, animals, weeds, or unwanted plants. The impact of pesticide use, influenced by toxicity level, volume, and exposure rate, significantly affects health. In addition, pesticide use on crops can leave residues on the plants themselves, as well as in the soil and surrounding environment [4].

Pesticides consist of chemical compounds that are known to be toxic to human health [5]. Improper use of pesticides can lead to contamination of food and water, which may trigger various diseases. Long-term effects of pesticide exposure include hormonal disorders, cancer, and damage to the nervous system. Moreover, pesticides can cause acute poisoning if inhaled or ingested in large amounts. It is therefore important to follow proper instructions for use and wear personal protective equipment (PPE) when applying pesticides. Safer alternatives, such as biopesticides or natural pest control techniques, are increasingly recommended. Biopesticides are substances derived from living organisms that can inhibit the growth, development, or survival of pests and disease-causing pathogens [6]. Types of biopesticides include bio-bactericides, bio-nematicides, and bio-herbicides [7]. Strict regulations and monitoring of pesticide residues in agricultural products are also necessary to protect consumer health. Health risks from pesticides can be minimized through wise management.

There are several risk factors that can lead to pesticide poisoning among farmers, including users' attitudes and behavior, the use of protective equipment, and the lack of information regarding risks and safe pesticide use [8]. Farmers who do not comply with pesticide usage guidelines or neglect safety procedures are more vulnerable to poisoning. Furthermore, inadequate use—or even complete absence—of personal protective equipment increases the risk of pesticide exposure. Limited training and knowledge on safe pesticide practices is another significant factor. Many farmers remain unaware of both the immediate and long-term dangers of pesticide exposure. Information regarding proper storage, mixing, and application of pesticides is often unavailable or poorly disseminated.

Unsafe and improper use of pesticides remains a common issue. Initial observations revealed that the majority of farmers do not use personal protective equipment (PPE) when spraying pesticides. The duration, frequency, dosage, and even wind direction during spraying are still not considered properly by farmers [9]. Such practices not only endanger farmers' health but also risk damaging soil fertility and the surrounding environment. The lack of understanding regarding the dangers of pesticides and their safe use worsens the situation. Therefore, outreach and education efforts are needed to raise farmers' awareness about pesticide hazards and proper application methods. This community service program aims to increase the awareness and knowledge of farmers in Giripurno Village regarding safe pesticide use, thereby safeguarding their health, preserving soil fertility, and supporting more sustainable agricultural practices [10].

2. EXPERIMENTAL METHOD

The implementation method was carried out through several stages, as follows:

2.1 Time and Place of Implementation

The outreach and community service activities were conducted on Friday, May 31, 2024, at the Secretariat of the *Mandiri Sejahtera* Farmers' Group, Giripurno Village, Bumiaji District, Batu City. This location was chosen because it serves as the regular meeting place for the members of the Farmers' Association.

2.2 Target Audience

The main target of this outreach activity was the male members of the Farmers' Association in Giripurno Village.

2.3 Outreach Materials

The materials delivered in this outreach activity focused on the dangers of pesticides and their safe usage. The topics included:

a. Classification of pesticides
b. Pesticide toxicity
c. Pesticide content and its impact on the environment
d. Health risks caused by pesticide use

2.4 Stages of Implementation

a. Preliminary Study
   This initial stage aimed to understand the context and situation of farmers in Giripurno Village regarding pesticide use in crop cultivation. Field observations and interviews with farmers and related stakeholders were carried out to identify existing problems and needs.
b. Education and Outreach
   This stage began with an outreach session that included a presentation on the harmful contents of pesticides and safe usage practices. The purpose was to provide farmers with information on how to use pesticides safely and in accordance with established standards. The material was presented using visual media such as PowerPoint slides and brochures to facilitate audience understanding. After the outreach session, participants were given the opportunity to ask questions about the materials presented.
c. Questionnaire Distribution
   At this stage, participants were asked to fill out questionnaires before and after the outreach activity to evaluate its effectiveness. The pre-activity questionnaire aimed to measure participants' initial knowledge about the dangers of pesticide use, while the post-activity questionnaire aimed to assess the improvement in participants' understanding after the session. The results of these questionnaires were analyzed to measure the success of the outreach program and to identify aspects that need improvement in the future.

2.5 Evaluation

After the activities were completed, an analysis of the questionnaire results was conducted to evaluate the improvement in participants' knowledge. This evaluation was essential to ensure that the objectives of the activity were achieved and that farmers gained better understanding of safe pesticide use, thereby reducing pesticide-related risks.

3. RESULTS AND DISCUSSION

The outreach activity on the dangers of pesticides and the safe use of pesticides for farmers began by inviting members of the Farmers' Association of Giripurno Village to attend the event. A total of 17 participants from various hamlets in Giripurno Village were present. Before the session started, brochures on the dangers of pesticides and their impacts were distributed to the participants. The next activity was the distribution of a pre-session questionnaire to measure the participants' initial knowledge regarding the dangers of pesticide use.

a. Implementation of the Initial Questionnaire
   To bring about a change in mindset and improve understanding of the dangers of pesticides and their impacts, an initial questionnaire was administered before the activity began. A total of seven multiple-choice questions were given. The questionnaire contained questions regarding the importance of pesticide use and farmers' knowledge of the associated health risks and their handling. Based on the

questionnaire results related to knowledge of health risks caused by pesticide use and their handling, out of 17 farmers: 4 farmers were categorized as very good (23%), 7 farmers as good (42%), 2 farmers as fairly good (12%), and 4 farmers as poor (23%). Thus, it can be concluded that knowledge about pesticide side effects and their management among farmers in Giripurno Village has not yet reached an optimal level.

b. Implementation of the Final Questionnaire

In addition to the initial questionnaire, a final questionnaire was also administered to measure the success of the activity. The number of participants who took this test was the same, namely 17. Participants' understanding of the material increased compared to before the presentation. This can be seen from the questionnaire results: 12 farmers demonstrated a very good level of understanding (70%), 4 farmers were categorized as good (23%), and 1 farmer as fairly good (7%). This improvement occurred because the participants were very enthusiastic in following the material presented.

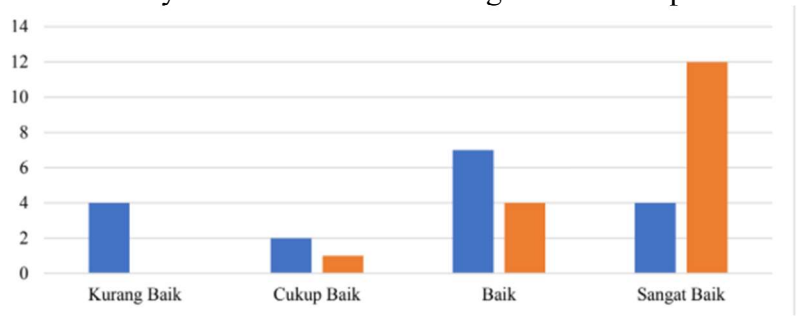

Figure 1. Graph of Respondents' Questionnaire on the Socialization of the Dangers and Safe Use of Pesticides for Farmers

In addition to the presentation of materials, participants were also given knowledge about the importance of using Personal Protective Equipment (PPE) while working in the fields. Through this activity, it is expected that participants will apply this knowledge in their farming practices over the long term.

Table 1. Resulit Before and After Questionnaire Completion

Sample	Percentage (%)
Before	23,53
After	88,24

4. CONCLUSION

From the outreach activity conducted in May 2024, it can be concluded that farmers in Giripurno Village need to pay greater attention to the dosage of pesticide use in agricultural activities and use Personal Protective Equipment (PPE) while working in order to avoid illness and poisoning caused by pesticides. This is intended to minimize the risk of occupational diseases. For the affected community, this program can serve as a new reference in their work, creating a sense of safety and comfort while working.

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