

Original Research

Farmer's Pesticide Safety Management: A Study of Behaviour in Pesticide Storage and Rinse Houses Usage

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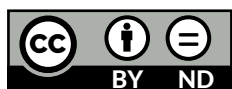
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ABSTRACT

Background: It is required to provide adequate equipment to optimize farmers' pesticide safety management. Pesticide storage and rinsing facilities are necessary to improve farmers' pesticide safety management practices. Water, personal protective equipment (PPE), a pesticide box, and a first-aid box are all included. This study focuses on describing farmer behaviour in terms of pesticide storage and the use of rinse homes. **Methods:** Seven farmers from X Village's farmer group participated in this qualitative study. In-depth semi-structured interviews and observation were used to gather data. Interviews were taped and transcribed word by word, then categorized and coded. The data was interpreted, and the outcomes were examined accordingly. **Results:** The findings revealed that the farmers did not make effective use of the amenities. They simply used the water facilities for hand washing and tank rinsing, and they only wore masks instead of full PPE. The findings revealed that farmers are aware of the dangers of pesticides, but they are comfortable with their old practices and rely on the farmer's habits. The pesticide box increases storing behaviour significantly. Farmers have also made use of the first-aid kit. **Conclusion:** According to this research, the provision of facilities has not been able to modify farmers' behaviour in pesticide safety management. The first step towards changing one's behaviour is to become aware of the problem. The more intensive contact between planners, farmers, and other stakeholders are essential.

Keywords: Pesticide safety management; farmers; behavior; facility; pesticide storage; rinse houses

1. INTRODUCTION

Agriculture is one of the major economic contributors in the Ponorogo Regency. As a result, a concerted effort is required to assure its long-term viability. Agricultural activities are quite complicated, and farmers must contend with plant pests that can reduce productivity. As a result, farmers must employ inorganic pesticides to combat this issue.⁽¹⁻³⁾

Farmers from X Village in Ponorogo Regency are one of the farmers groups that utilize inorganic pesticides. Rice and horticulture crops including chiles, shallots, melons, and soybeans are examples of agriculture. Inorganic pesticides are widely used by farmers, notably in horticultural agriculture. As a result, researchers found that 5.26 percent of farmers used pesticides well, 56.14 percent used them moderately, and 38.6 percent used them poorly in 2020.⁽⁴⁾ According to the study of Rosanti et al. (2021),⁽⁵⁾ Pesticide levels in farmers' blood with no personal protective equipment are 10.53 percent extremely high risk, 29.82 percent high risk, 45.61 percent medium risk, and 14.04 percent low risk. As

a result, the researchers created pesticide storage and rinsed houses to reach a safe agricultural town, which they have been working on since 2020. The safety farming village is a farming activity that focuses on safety and health to avoid workplace accidents and illnesses.⁽⁶⁾

One of the tools for implementing pesticide safety management is pesticide storage and rinse house. Pesticide activities must involve safety issues such as purchasing, storage, handling, spraying, rinsing, disposal of empty bottles, and farmer personal hygiene in pesticide safety management.^(2,7) Pesticide use must be controlled in an integrated manner to reduce health risks.⁽⁸⁾ The house was constructed in a location in X Village that could be reached by five farmer groups. A pesticide box, personal protective equipment (PPE), fire extinguisher, first aid kit box, posters, brochures, and bathing facilities are all available.

According to prior research, farmers with a thorough understanding of pesticide hazards cannot modify pesticide safety management because they are more concerned with the economic side.⁽⁹⁾ Other research has revealed that a community effort is required to change farmers' behaviour.⁽¹⁰⁾ Furthermore, research shows that cultural and individual methods might help analyze educational interventions on farmer safety behaviour through various media.⁽¹¹⁾ This study examines the effectiveness of employing pesticide storage and rinse houses by looking at farmer behaviour in using the facility to raise farmers' awareness of the dangers of pesticide use.

Despite the increasing implementation of pesticide storage and rinse houses in agricultural settings, limited evidence exists regarding their effectiveness in shaping farmers' safety behavior, particularly in real-world rural contexts. Previous studies have largely focused on pesticide exposure levels and health risks, while behavioral changes related to safety facility utilization remain underexplored. Previous research has predominantly focused on pesticide exposure and its associated health risks among farmers, including the accumulation of pesticide residues in the human body and the occurrence of both carcinogenic and non-carcinogenic health effects.⁽¹²⁻¹⁴⁾ These studies consistently show that pesticide exposure through occupational activities and food consumption pathways poses significant short-term and long-term health risks, particularly among agricultural workers. However, limited attention has been given to behavioral aspects of pesticide safety, especially regarding the utilization of

safety facilities at the community level. Consequently, there is still limited understanding of farmers' safety behavior and its determinants, particularly in developing countries.⁽¹⁵⁾ Research in Pakistan also found that education, farming experience, and training significantly improved the adoption of protective measures, thereby reducing health risks.⁽¹⁶⁾ Nevertheless, existing studies tend to emphasize exposure and health outcomes, while behavioral interventions receive comparatively less attention.

Therefore, this study aims to evaluate the effectiveness of pesticide storage and rinse house utilization in influencing farmers' safety behavior, particularly in terms of safe handling, storage, and post-use hygiene practices. The findings of this study are expected to contribute to the development of evidence-based interventions for improving pesticide safety management at the community level. Additionally, this study provides policymakers and agricultural stakeholders with practical insights for optimizing the use of safety facilities to reduce pesticide-related health risks among farmers.

2. METHODS

2.1 Study Design

This study employs a qualitative case study design to explore farmers' safety behaviors regarding the use of pesticide storage and rinse house. A qualitative approach was chosen because it enables researchers to gain a deep understanding of respondents' experiences, perceptions, and practices in real-life contexts. According to Sutton and Austin,⁽¹⁷⁾ qualitative data is exact and essential for understanding how and why respondents behave in this way.

2.2 Participants

This research took place in X Village, Ponorogo Regency, from March to June 2021. Each respondent was subjected to semi-structured interviews and observations. The participants in this study were farmers in Village X, Ponorogo Regency. The village consists of seven farmer groups, which served as the basis for selecting informants. A purposive sampling technique was used to select informants with direct experience in pesticide use and who understood the use of pesticide storage facilities and washing stations.

A total of 7 informants participated in this study, with 1 representative from each farmer group. This

approach was taken to ensure representation across the farmer groups. Data collection continued until data saturation was achieved. The inclusion criteria for this study were: (1) farmers who are members of a farming group in Village X; (2) actively use pesticides; (3) have access to or experience using pesticide storage facilities and wash houses; and (4) are willing to serve as informants by providing informed consent. Exclusion criteria include: (1) farmers who are not active in activities related to pesticide use; (2) those without experience with pesticide storage facilities or washrooms; and (3) those who refuse to participate or are unable to complete the interview process.

2.3 Data Collection

Data were collected through semi-structured interviews and direct observation. The interview guide was developed based on the research objectives to explore farmers' safety behaviors regarding pesticide use, particularly concerning the use of pesticide storage facilities and washing stations. Interviews were conducted face-to-face in the respondents' work environments, primarily in rice fields or surrounding areas, to ensure the research context remained relevant. Each interview lasted approximately 15–20 minutes and was conducted flexibly, allowing informants to explain their experiences and perspectives in depth.

With the informants' consent, interview data were documented through note-taking and, where possible, audio recording. In addition to interviews, direct observations were conducted to assess farmers' behaviors and the conditions of pesticide storage facilities and wash stations. This combination of interview and observation methods allowed for data triangulation, thereby enhancing the credibility of the research findings.

2.4 Data Analysis

The data were analyzed using thematic analysis. All interview data were transcribed and read repeatedly to develop a deep understanding of their content. Subsequently, an initial coding process was conducted based on units of meaning relevant to the research objectives. These codes were then grouped into broader categories and themes representing patterns of farmers' safety behaviors, particularly regarding the use of pesticide storage and rinse houses. The analysis was conducted iteratively, allowing refinement of codes and themes as new information emerged. Data from

observations were used to supplement and validate findings from the interviews. This process allowed for data triangulation, thereby enhancing the credibility of the analysis results. To ensure data validity, the researcher maintain consistency in the coding and interpretation processes throughout the analysis.

3. RESULTS

3.1 Characteristics of Respondents

The following characteristics in Table 1 are derived from respondents who were willing to be interviewed. Table 1 shows that all respondents are horticultural farmers who have been farming at a young age and have a long working time of 11 to 41 years.

3.2 Farmers Information About Pesticide Storage and Rinse House

The researchers created questions in the questionnaire to learn more about farmers' knowledge of pesticide storage and rinse houses, and the results are as follows in Table 2. The findings indicate that farmers obtained information about pesticide storage and rinse house facilities from various informal sources, including researcher, farmer's group leaders and colleagues. This suggests that the dissemination of information remains largely informal and may not be systematically delivered. As one farmer explained:

"I learned about pesticide storage and rinsing from a friend, but there was no clear information from the farmer group leader." (Farmer 5)

Furthermore, farmers showed varying levels of understanding regarding the purpose of these facilities. While some associated them with reducing pesticide exposure, others perceived them mainly as a place for first aid or personal hygiene. This variation indicates that farmers' understanding of the intended function of pesticide safety facilities is still inconsistent.

The findings revealed that basic safety equipment was available to most farmers, including Personal Protective Equipment (PPE), first-aid boxes, and bathing facilities. In some cases, additional safety tools such as fire extinguishers and informational posters were also present. However, the availability of these facilities varied across participants, and not all farmers had access to a complete set of equipment. This inconsistency suggests that while safety infrastructure exists, its distribution and completeness are uneven among farmers.

Table 1. Characteristics of respondents

Farmer ID	Age (years)	Experience (years)	Education	Kind of crops
1	54	20	Bachelor	Horticulture
2	54	25	Junior high school	Horticulture
3	46	16	Elementary school	Horticulture
4	32	11	Senior high school	Horticulture
5	48	17	Junior high school	Horticulture
6	60	41	Elementary school	Horticulture
7	47	17	Junior high school	Horticulture

Table 2. Farmers information about pesticide storage and rinse house

Farmer ID	Source of Information	Aims	Existing Equipment
1	Researcher	Reduce pesticide exposure	PPE, first aid box, fire extinguisher, pesticide box, poster, leaflet, and bath facilities
2	Farmer's group leader	First aid	First aid box
3	Farmer's group leader	Provision of PPE	First aid box and bath facilities
4	Farmer's group leader	Provision of PPE	PPE, first aid box and bath facilities
5	Colleague	Provision of PPE and first aid	PPE and first aid box
6	Colleague	Provision of PPE, first aid and take a bath	PPE, first aid box and bath facilities
7	Colleague	Provision of PPE	PPE

3.3 Utilization of Pesticide Storage and Rinse House

In addition, each farmer was asked to respond to the following questions about pesticide storage and rinse houses. Table 3 demonstrates how each farmer uses pesticide storage and rinse house differently, starting with PPE usage, storing pesticides, first aid box, taking a bath, and noticing the poster.

The findings indicate that farmers' utilization of pesticide storage and rinse house facilities remains inconsistent and largely influenced by personal habits and perceptions. Although the facilities were available, many farmers preferred to rely on their existing practices rather than adopting the provided safety measures.

Some farmers expressed that they were already accustomed to their current routines and did not perceive the facilities as necessary. One farmer stated:

"This place is nice, but I am already used to my current practices. The program feels more like agriculture than health." (Farmer 2)

Similarly, another farmer mentioned that he preferred to use his own hut instead of the designated rinse house:

"Even though I know this house exists, I already have my own hut and clean myself there." (Farmer 6)

In addition, farmers demonstrated limited adherence to recommended hygiene practices after pesticide application. While taking a full bath is encouraged, several farmers reported only washing their hands due to time constraints or inconvenience:

"After spraying, I usually just wash my hands. Taking a full bath takes too much time." (Farmer 3)

"Showering removes all the dirt, but I often just wash my hands because I am in a hurry." (Farmer 7)

This indicates that personal convenience plays a significant role in determining hygiene behavior among farmers. Furthermore, the use of Personal Protective Equipment (PPE) was also inconsistent. Although PPE was available, some farmers reported discomfort as a major barrier to its proper use:

"The PPE is complete, but it is uncomfortable to wear, so I only use the mask." (Farmer 1)

"Wearing PPE is bothersome. Sometimes I just use a cloth instead of a proper mask." (Farmer 2)

These findings indicate that the availability of facilities and equipment does not necessarily ensure their proper utilization, as behavioral factors such as habits, perceptions, and comfort strongly influence farmers' practices. This underscores a critical gap between the provision of safety facilities and their actual adoption by farmers.

Table 3. Farmers utilization about pesticide storage and rinse house

Farmer ID	PPE	Storing pesticide	First aid box	Take a bath	Notice the poster
1	Mask	Pesticide Storage and Rinse House	Yes	Rare	Rare
2	None	Own hut	Yes	Just for washing hand	Never
3	Mask	Pesticide Storage and Rinse House	Yes	Rare	Rare
4	Mask	Own hut	Yes	Rare	Rare
5	None	Own hut	No	Washing hand in own hut	Never
6	None	Own hut	No	Washing hand in own hut	Once
7	None	Own hut	No	Washing hand in own hut	Never

4. DISCUSSION

This research is aimed at farmer knowledge about the existence of pesticide boxes and rinses houses. This study shows that the availability of pesticide storage facilities and rinse houses does not necessarily guarantee their optimal use by farmers. Even though these facilities are available, farmers' behavior in using them is still heavily influenced by habits, perceptions, and convenience.

The informant determines the farmers' awareness of the benefits and facilities offered in the pesticide storage and rinses house. It explains why farmer group leaders' information to their members isn't delivered relatively. Farmers only get a portion of the data. As a result, the role of the farmer group leader as a change agent in pesticide safety management is critical because farmers, unlike other parties, engage extensively with one another. According to earlier research, friendship is one of the factors that can affect farmers' behaviour, according to an earlier study.⁽¹⁰⁾ Therefore, a personal approach is critical to the program's success. Farmer 1 is the leader of one of the farmer organizations. Thus, he has a lot of information. Farmer 1 is mainly dedicated to the program's success and appreciates a personal approach from researchers.

The research findings also indicate that farmers' understanding of the facility's function varies. Some farmers associate it with efforts to reduce pesticide exposure, while others view it more as a means of first aid or personal hygiene. This variation suggests that information dissemination within farmer groups has not been optimal. This finding aligns with previous research showing that informal communication often leads to incomplete understanding among farmers.⁽¹⁶⁾

In terms of usage, farmers tend to stick to existing practices, such as using their own huts and simply washing their hands instead of taking a shower after spraying. The behaviour in using the house will be determined by knowledge of its presence and benefits. Farmers 1, 3, and 4 who received information directly from the group leader showed this by trying to utilize PPE while being humble and willing to take first aid. The farmer did use improvised PPE during spraying, according to the results of the observations. Various elements influence a person's health behaviour, one of which is knowledge.^(18,19) Although the PPE storage is complete, the farmers have not used it entirely due to discomfort. As a result, it is vital to assess the current PPE. PPE must be tailored to the dangers and hazards encountered in agricultural activities, taking into account efficacy, comfort, and precision in use.^(20,21)

In terms of pesticide storage, the researchers found that, although not all farmers desire to keep pesticides in the pesticide storage and rinse house, they do so in their rice huts, based on interviews and observations. Farmers 1 and 3 preserve the pesticide storage and rinse building on their farm's premises. It demonstrates that one factor to examine in determining the efficiency of a facility's use is its affordability.⁽²²⁾

The presence of a first aid box is meant to allow farmers to perform prompt first aid using accessible instruments and drugs in the event of a minor labour accident.⁽²⁰⁾ Farmers have previously stated that they are frequently exposed to snail shells and stumps. On the other hand, farmers are hesitant to treat it, preferring to pour clean water over it and go about their work. Even though farmers 5 and 6 were aware of the presence of the first aid kit, they did not use it. It demonstrates that traditions or habits significantly impact behaviour despite having access to adequate knowledge and resources.⁽¹¹⁾

The pesticide storage and rinse house provide bathing facilities that support personal hygiene and help prevent the transfer of pesticide residues into the home environment. However, despite farmers' awareness of the importance of bathing after pesticide application, the practice is frequently delayed or not consistently performed. This suggests that knowledge alone is insufficient to ensure proper hygiene behavior, as practical constraints and established habits continue to influence farmers' actions.

According to the posters and brochures available, farmers should be aware of the hazards of pesticides and the necessity of pesticide storage and rinse house facilities. Farmers, on the other hand, admitted that they rarely saw the posters and brochures. It is supported by the fact that the pamphlets are still neatly placed, and the poster is flaking away from the wall patch. As a result, greater interactive and conversational efforts are required.⁽⁹⁾

Observations of the available facilities in the pesticide storage and rinse house revealed that farmers' use of Personal Protective Equipment (PPE) was limited, primarily to masks, while the first aid box contained only a few basic medicines and the bathing facilities were mainly used for handwashing and cleaning spraying equipment. These findings indicate that the available facilities are not fully utilized, and farmers' pesticide safety practices have shown little change despite the provision of appropriate infrastructure.

The influence of farmer groups in facility use was discovered to be highly crucial in this study. In addition, to modify their previous patterns, supervision and personal approach from affiliated individuals are required.^(20,23) The WHO also recommends a program of Integrated Pesticide Management (IPM). The level of education, social and economic conditions, environment, thought patterns, normal values, rules, equipment or facilities, knowledge cultivation, retail marking, and farmer perceptions greatly influence the success of IPM.⁽²⁴⁾

This study has several limitations. First, the study limited the number of informants to farmers in a single village, so its findings have limited generalizability. Second, the data were obtained through interviews and observations, which may be subject to subjective bias. Nevertheless, this study provides meaningful insights into farmers' behavior and the challenges they face in using pesticide safety facilities at the community level.

5. CONCLUSION

Farmers have not effectively used the pesticide storage and rinsing facilities, as they are still accustomed to their previous practices. Farmers' behaviour in pesticide safety management has not changed as a result of the facilities. For the most successful use of facilities, structured supervision activities are essential, as is more extensive communication between planners, farmers group leaders, and other stakeholders. Future research should explore intervention-based approaches to improve the utilization of pesticide storage and rinse house facilities, particularly through behavioral change strategies. Longitudinal or quasi-experimental studies are recommended to evaluate the effectiveness of structured supervision, participatory communication, and farmer group engagement in promoting sustainable pesticide safety practices. In addition, further studies are needed to assess the role of facility design, accessibility, and user comfort in influencing farmers' adoption of safety measures.

Ethical Approval

Ethical approval for this study was granted by the Ethics Committee of RSUD Dr. Hardjono Ponorogo (registration number: 3502021K121442020082100002/IX/KEPK/2020).

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Competing Interests

All the authors declare that there are no conflicts of interest.

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Underlying Data

The author has nothing to report.

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