Jurnal Agrinika: Jurnal Agroteknologi dan Agribisnis
Volume 08, Issue 01 (2024)
E-ISSN: 2721-2807

Knowledge Level of Farmers regarding the Use of Pesticide for Pest and Disease Control

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Keywords:
Disease control;
Farmer's level knowledge;
IPM;
Pesticides;
Pest Control.

Submited:
06-11-2023

Accepted:
22-03-2024

Published:
29-03-2024

ABSTRACT

Farmers' utilization of pesticides in Indonesia is very high because pesticides are the main method for farmers to control pests and diseases. This research was conducted to determine farmers' level of knowledge of the use of pesticides. The research method used in this research was quantitative, using survey methods. The survey method was used to obtain factual information by exploring the level of knowledge, attitudes and actions of farmers related to pesticides. Sampling was conducted in Tulungrejo Village, Ngantang District, Malang Regency, with 50 farmers as respondents. The results of this study found that most of the respondents know about pesticides and the types of pesticides. The primary factor influencing pesticide use selection was the characteristics of farmers. The farmer age in Tulungrejo Village is 56%, and the farmer is 30-50 years old. Most of them had a low educational level, and 48% of the farmers only finished elementary school. However, the respondents needed to learn that the use of pesticides should be the last step in controlling pests and diseases, according to Integrated Pest Management (IPM). Therefore, an education and training program on IPM and pesticide use should be planned to assist farmers in improving their knowledge and skills.

1. Introduction

Plant-disturbing organisms are one of the biggest problems in the agricultural sector. Pesticides are the main way to control weeds, pests and plant diseases (Djojosumarto, 2008). Some advantages of pesticides include relatively low cost and reliability, high killing success rate, and easy use (Stenerson, 2004). In addition, the availability of pesticide ingredients is also quite easy to find in agricultural shops (Yuantari *et al*., 2015). The advantages of using pesticides have proven to be large, giving rise to the discourse that the use of pesticides is the main factor in determining high production yields and improving the quality of agricultural products (Agus, 2011).

The opinion of some farmers about the effectiveness of pesticides in controlling pest and disease populations provides new facts. This success lasted only briefly; even the pest population could increase (Indiati & Marwoto, 2017). Some pesticides have also been shown

to be related to health and environmental issues (Zheng *et al*., 2016), especially the use of pesticides in agriculture. For this reason, various ways have been taken to increase agricultural yields by reducing the impact of environmental pollution through sustainable agriculture (Sutanto, 2002). Unfortunately, climate change triggers an increase in the use of active pesticide ingredients, which is predicted to be around 60% until 2100 (Koleva & Schneider, 2009). Of course, this further increases the accumulation of pesticide exposure in the environment.

Farmers' exposure to pesticides is significant, particularly in rural regions. Therefore, it is crucial to comprehend the farmers' knowledge levels, attitudes, and awareness regarding pesticide safety. This aids in formulating effective educational and policy measures to mitigate pesticide risks and minimize potential pollution in agricultural environments. The research examines farmers' knowledge, attitudes, and practices in Kaivara village, located in South Karnataka, India, which was carried out by Satya Sai *et al*. (2019). In that research, A group comprising 118 men and 53 women, with a median age of 40, participated in the study. Approximately 61% of the farmers were aware of the adverse effects of pesticides. Nevertheless, 22% of participants were found to be mixing pesticides with their bare hands, while 26% did not use any protective clothing while spraying pesticides. Additionally, roughly 67% of farmers were improperly disposing of leftover pesticides in open fields.

On the other hand, another study about Farmers' knowledge and research conducted on practices and injuries within the rural community of Tanzania revealed a significant risk of pesticide exposure. Surprisingly, farmers' levels of knowledge did not seem to correlate with their risk of exposure (Lekei *et al*., 2014). The research results suggested that instead of solely emphasizing knowledge-based strategies, it is imperative to implement comprehensive interventions to diminish exposure and health hazards. These interventions may encompass training initiatives, enhancements in labeling, initiatives to mitigate cost obstacles hindering the adoption of safe practices, advocacy for control methods beyond personal protective equipment (PPE) and backing for Integrated Pest Management (IPM).

Pesticide exposure has an impact on various trophic levels, including humans. Contact and residue on the human body can affect skin, digestion, and respiration (Kumar *et al*., 2012). A study about the high potential of pesticide exposure was found in 2014. The study revealed that 93% of farmers in the chosen rural Tanzanian community reported experiencing pesticide poisoning at some point. (Lekei *et al*., 2014). The pesticide type, application duration and frequency, and human health factors can influence the severity level. In the human and animal bodies, pesticides may undergo metabolism, excretion, storage, or bioaccumulation in body fat. Several diseases that correlate with pesticides include skin, nerve, cancer, respiratory, reproductive, and endocrine problems. Accumulation in high concentrations can even cause death (Stoytcheva, 2011).

There have been many studies on the level of farmers' knowledge about the use of pesticides. However, this research has yet to be conducted in Tulungrejo Village, Ngantang District, Malang Regency. Even though the people there still use pesticides in large quantities. Therefore, it is important to conduct this research to collect information about the extent of farmers' understanding regarding pesticide usage. From the results of this study, it was also possible to carry out further research regarding the use of biological control as one of the controls in IPM for alternatives to reducing pesticide use in Tulungrejo Village, Ngantang District, Malang Regency

2. Methodology

The This research was carried out from July to November 2022 in Tulungrejo Village, Ngantang District, Malang Regency. The choice of Tulungrejo village is because, in this area, the community's main livelihood is as a farmer due to low education. The use of pesticides there is still ongoing and more intensive when farmers grow vegetables. The number of farmers interviewed was 50 people. The research method used is quantitative, with a research design using survey methods. This research survey is explorative. The survey method is used to obtain facts. In addition, this method seeks factual information by exploring aspects of farmers' knowledge, attitudes and actions related to pesticides. Information was obtained through an interview with the help of a structured questionnaire. The questionnaire was initially drafted in English and later translated into Indonesian to ensure comprehension and avoid potential language barriers (Mubushar *et al*., 2019). The method of obtaining other information is also using interviews with informants who are considered to know about the knowledge and actions of farmers who use pesticides in the area. Research information was obtained in the form of basic data on farmers. Basic information such as age, educational status, area of land owned and land ownership status of farmers. Other research information obtained consists of aspects of farmers' knowledge, attitudes and actions of farmers in the field related to pesticides.

3. Results and Discussion

This research was conducted in Tulungrejo Village, Ngantang District, Malang Regency, from July to October 2022. Tulungrejo Village is divided into 4 hamlets, namely Jabon, Sayang, Gagar and Ganten. The total population of Tulungrejo Village is 3717 residents, with 2025 males and 1688 females. Of the 3717 residents, 442 people work as farmers. The livelihood of farmers is 185 people, sharecroppers are 39 people, and farm laborers are 218 people. Therefore, this study interviewed 50 farmers as respondents, and the sampling determination was taken from 10% of the farmers.

3.1 Characteristics of Farmers.

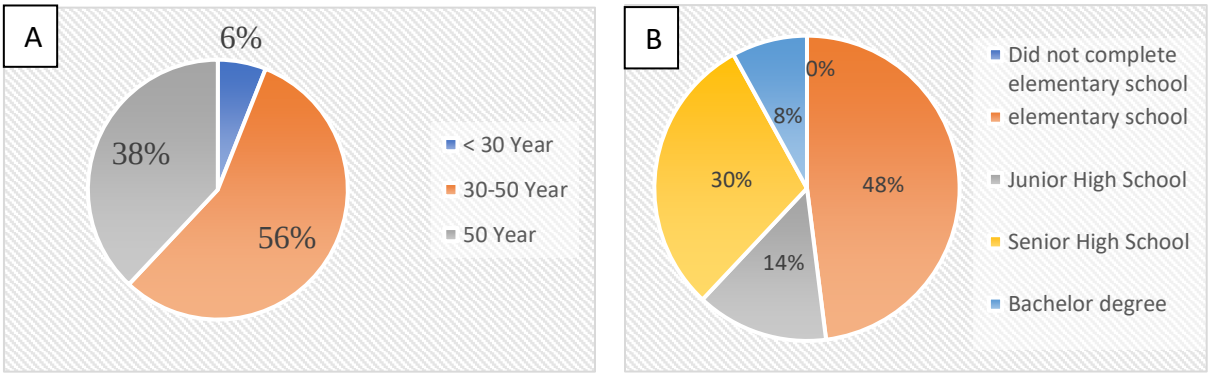

Figure 1. Characteristics of farmers. A: Characteristics of respondents by age, B: Characteristics of respondents based on education background

The characteristics of the respondent farmers in Tulungrejo Village, Ngantang District, Malang Regency are divided into 4 groups based on Age, Land Area, Education and Land Ownership. Based on the age shown in Figure 1A, the highest score is 56% of the respondent

farmers aged between 30-50 years. This is followed by farmers over 50 years or as much as 38%. This is because 30-50 is a person's productive age when the energy is still strong and capable of cultivating agricultural land. This result is equal according to (Mubushar *et al*., 2019), Most farmers in Pakistan are in the age range of 30-39, followed by those in the 40-49 age group and the 20-29 age group. The smallest proportion of respondents falls within the age group of 50 and above.

Based on the area of land owned, as much as 44% of farmers own/work on 0.5 – 1 Ha of land. For farmers who own/work on land less than 0.5 Ha, it is as much as 40%. Meanwhile, farmers who own/work on more than 1 ha account for as much as 16% of the total land use. This is because more farmers own land and cultivate tenants. The average education of farmers in Tulungrejo Village, Ngantang District, Malang Regency is Elementary School, which is 48%; Middle School, 14%; High School, 30%; and Higher Education is 8% (Figure 1B).

The level of education determines the level of knowledge, especially for farming and the use of pesticides. Farmers with higher levels of education demonstrate a superior comprehension of the impacts of pesticides on both health and the environment. These results are in accordance with (Khan & Iqbal, 2009), the majority of farmers in Pakistan possess a limited level of education, with only 6% having attained a university degree.

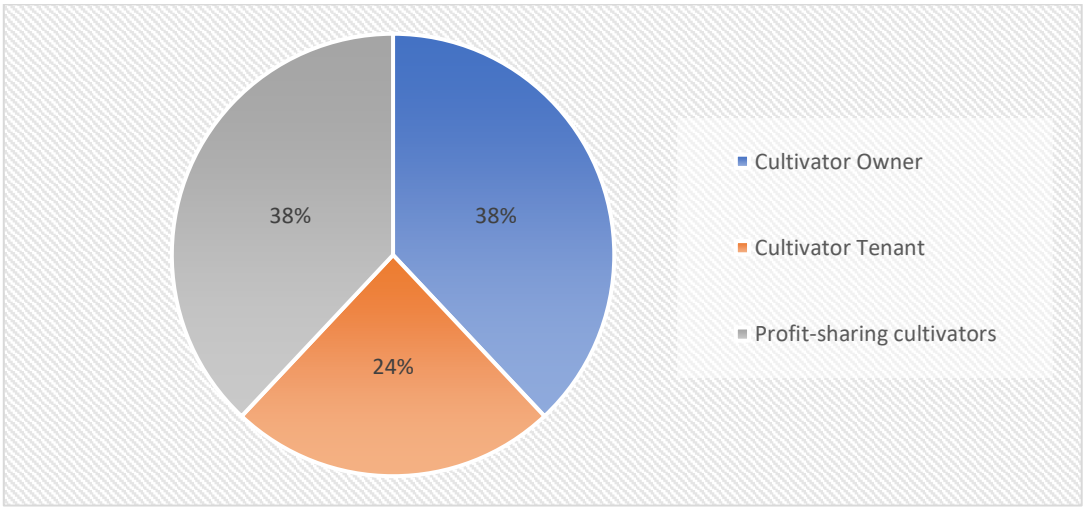

Figure 2. Characteristics of Respondents Based on Land Ownership

In Figure 2, we can see the characteristics of respondents based on land ownership. The result showed that 38% of the farmers are cultivator owners, 24% are cultivator tenants, and 38% are profit-sharing cultivators. On average, farmers with higher education are sharecroppers who do not go down to agricultural land. Meanwhile, most primary school-educated farmers are sharecroppers, both landowners and tenants. The profit-sharing system in Tulungrejo Village is 70% and 30%. The land owner will get 70% of the crop, and the cultivator will get 30%. However, the land owner must provide all the agricultural inputs needed, starting from equipment and materials such as seeds/seeds, fertilizers, and pesticides. At the same time, the land cultivators provide their energy, from land processing to harvesting.

3.2 Knowledge of Pesticide Regarding the Use of Pesticides

Based on the characteristics of farmers in Tulungrejo Village. The primary factors for choosing to use pesticides are age and education level. Most of the farmers only finish their elementary school. From the questions regarding pesticides in Figure 3, it can be seen that almost all farmers already know what pesticides are. However, only 60% of farmers know pesticides can be mixed, and 34% said they cannot. As many as 40% of farmers stated that it is true that pesticides for insects with the same brand can be used for fungal diseases, even though this is wrong because pesticides are species-specific. But almost all, namely, 98% of farmers, know that the application of pesticides must use personal protective equipment. Likewise, with knowledge regarding the correct dosage for the use of pesticides, as many as 94% of farmers already understand this sense. 90% of farmers also know pesticides can kill natural enemies of pests or other beneficial living things. 72% of farmers in Tulungrejo Village stated that it is true that pesticides are substances that are harmful to health even though they have received permission from the government. From this table, it can be seen that most farmers in Tulungrejo Village know about pesticides, dosages, and how to apply them, and they also state that pesticides are dangerous.

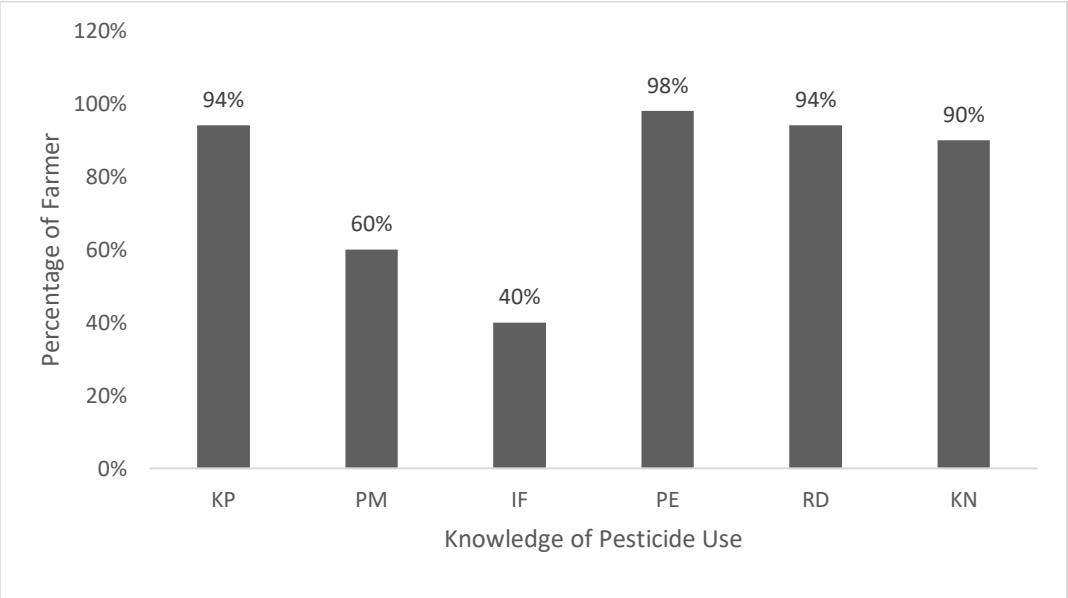

Figure 3. Knowledge of Pesticide Use

Note:
KP : Know about pesticide.
PM : All pesticides can be mixed.
IF : Insecticide can be used for fungal diseases.
PE : Need personal protective equipment for the application .
RD : Need the right dosage for the use of pesticides.
KN : Pesticides can kill natural enemies or other useful living creatures.

3.3 Knowledge of Pesticides for Pest Control

Farmers in Tulungrejo Village still need clarification about pesticides for pest and disease control. It is known from Table 1 that 42% still answered correctly that all pesticides can control pests and diseases. Still, there are no specific pesticides for certain pests and diseases, whereas pesticides are species-specific. However, 70% of farmers know that fungicides control fungi. And 68% know that insecticides are pesticides that control insect pests. Also, 60% know that herbicides are pesticides used to control weeds. Thus, it is evident that farmers understand various types of pesticides, including fungicides, insecticides, and herbicides. According to Hermanto *et al*., (2019) the farmers of Karo have the perception to control pests and diseases plants in the field using pesticides; 75% of farmers apply chemical pesticides without evaluating the incidence of pest and disease attacks. For most farmers in Kuwait, particularly those engaged in vegetable production within greenhouse settings, reliance on chemical pesticides is imperative. This dependence arises from farmers' limited access to alternative, non-synthetic pest control methods.

Table 1. Average Erosivity Region Study Period 5 Years

No	Statement		Percentage
1	All pesticides can control pests and diseases, there are no specific pesticides for certain disease pests	Right	42%
		Wrong	56%
		Didn’t know	2%
2	Fungicides are pesticides to control fungi	Right	70%
		Wrong	4%
		Didn’t know	26%
3	Insecticides are pesticides to control insect pests	Right	68%
		Wrong	16%
		Didn’t know	16%
4	Herbicides are pesticides for controlling weeds	Right	60%
		Wrong	6%
		Didn’t know	32%
5	Need other control measures before using pesticides, for example the use of pest traps etc	Right	44%
		Wrong	24%
		Didn’t know	32%
6	Each pest or disease attack must be sprayed with pesticides immediately, no need to look at the level of attack first	Right	64%
		Wrong	22%
		Didn’t know	16%
7	Spraying pesticides should be every week	Right	70%
		Wrong	24%
		Didn’t know	6%

According to Jallow *et al*., (2017) Lack of knowledge about pests and diseases make this is happened. Farmers do not understand the interplay among crops, pests, and their surrounding environment. (Atreya *et al*., 2022). Farmers' knowledge still needs to be improved

regarding the need for other control measures before using pesticides, such as pest traps, etc. So, farmers still need to understand IPM techniques or Integrated Pest Management. What farmers know is that every time there is a pest or disease attack, pesticides must be sprayed immediately; no need to look at the level of attack first. Even 70% of farmers stated that pesticide spraying should be done every week. This is because spraying pesticides is a habit.

IPM, or integrated pest management, is a philosophy that focuses on managing pests rather than removing or controlling them. A deeper understanding of the pest, crop, and environment is needed rather than working toward insect population eradication; this method focuses on utilizing natural ecosystem capabilities and controlling pest numbers within acceptable ranges. This will guarantee a sustainable future and prevent unfavorable short- and long-term ripple effects.

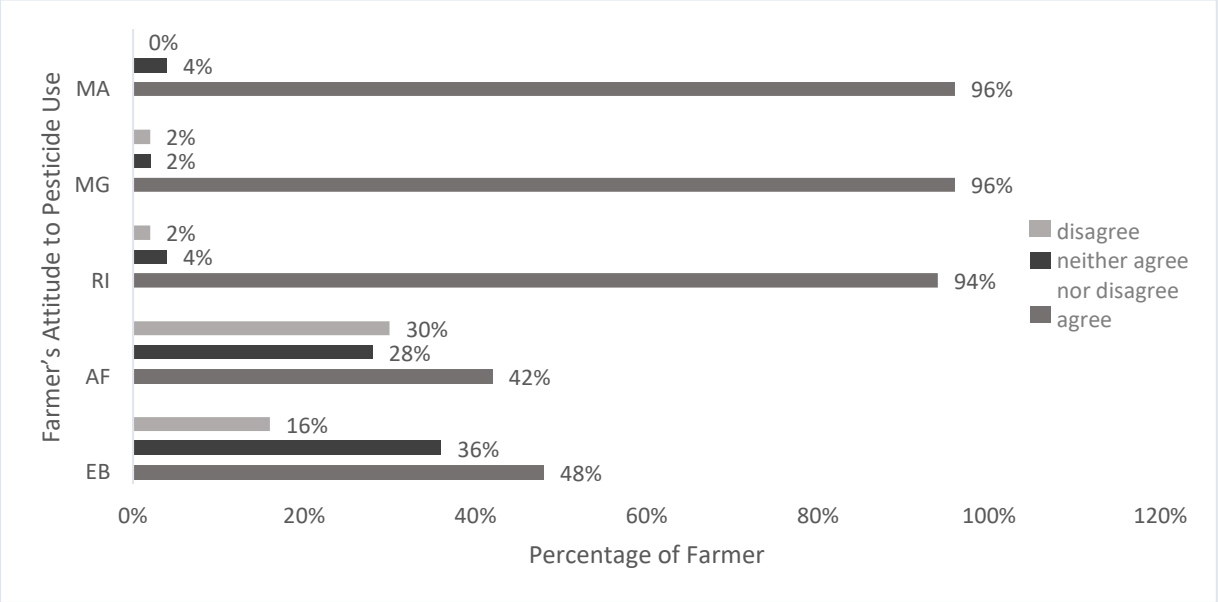

Figure 4. Actions Regarding the Use of Pesticides

Note:
MA : Morning application is recommended.
MG : Wearing mask and gloves before applying pesticides.
RI : Reading the instructions on the label before use.
AF : Applying pesticide according to other farmers. .
EB : Expensive pesticides are better.

Instead of "pesticide management objectives," IPM programs should be run with "pest management objectives." A complete long-term pest management strategy based on ecosystem knowledge that considers the financial, environmental, and social ramifications of treatments is known as integrated pest management (Flint and van den Bosch, 1981). Understanding and shoring up the whole composite of innate plant defenses, plant combinations, soil, natural enemies, and other system components should be the cornerstone for pest management in agricultural systems. A web of sustainable and renewable feedback loops connects these "built-in" natural regulators. Pesticide use and other "symptoms post-treatment" strategies should be the last option rather than the first line of defense because they are unsustainable. "Why is the pest a pest?" should always be the first question in any pest management plan. It should also address fundamental flaws in ecological systems and

agronomic practices that have coverings. 74% of respondent farmers also said they had never eaten/drank/smoked during the application. This shows that farmers were aware of wearing protective equipment while using pesticides. Awareness of this safety ware can reduce pesticide exposure and decrease the potency of health problems (Damalas & Eleftherohorinos, 2011). Exposure to pesticides is critical since skin contact becomes a possible route of exposure to pesticide toxicity. It is important to educate farmers in order to protect permitted species to acquire pest status. (Ehi-Eromosele *et al*., 2013)

3.4 Knowledge of Pesticides for Pest Control

Actions regarding the use of pesticides can be seen in Figure 4. This action is the level of knowledge of the steps taken by farmers against pesticides. More than half of the farmers know that when spraying pesticides, they must wear long sleeves and long pants, gloves, hats, masks/mouth coverings. 74% of respondent farmers also said they had never eaten/drank/smoked during the application. This shows that farmers were aware of wearing protective equipment while using pesticides. Awareness of this safety ware can reduce pesticide exposure and decrease the potency of health problems (Damalas & Eleftherohorinos, 2011). Exposure to pesticides is critical since skin contact becomes a possible route of exposure to pesticide toxicity. It is important to educate farmers in order to protect themselves (Gesesew *et al*., 2016). Moreover, it is crucial to convey the importance of farmers' attitudes and awareness levels regarding pesticide safety. Farmers also know that it is best to store pesticides in another place/warehouse and keep them out of reach of children. As much as 60% of the farmers stated that used pesticide cans were disposed of by burying them in the ground far from the well. If pesticide poisoning occurs, go to the doctor (66%) and drink coconut water (62%). Drinking coconut water has been known by farmers for generations if both pesticides and other drugs poison it.

Most farmers use less than three brands of pesticides in one planting period. Some 70% stated that the average frequency of pesticide use in a week was less than one time, while the other 30% were used 1-3 times a week. Regarding knowledge about mixing pesticides, 68% of farmers said they mixed 2-3 pesticides simultaneously. This is not good because pesticides are chemicals that can become dangerous or change their nature when mixed. The use of pesticides should not be mixed. Most farmers claim to store the pesticide in a storage room and dispose of it by burying it far from the water source. Since pesticides in the water body are derived from the agricultural field, it will not be easy to maintain the water quality around the field following the reduced clean water supply (Syafrudin *et al*., 2021). Correlating with the application method, mixing two or more pesticides with high frequency was reported to increase pesticide exposure. This exposure poses a long-term health hazard, especially in agricultural working environments. The more frequent the application, the higher the degree of toxicity in the field. This condition will create some risk of harm, not only to human health but also to wildlife, especially its impact on beneficial species (Damalas & Eleftherohorinos, 2011).

Fifteen farmers still apply pesticides at high frequency (1-3 times a week), indicating that guidance on pesticide application is needed. It was reported that visiting a doctor is mostly chosen as the first aid for pesticide poisoning, followed by drinking electrolytes obtained from coconut. This plant species has still become popular in natural detoxification in Indonesia. Culture developed in this county; specifically, the Javanese population believes that the water from green coconuts (Cocos *et al*.) possesses antidotal properties despite being unaware of

its contents. (Rachmawati *et al*., 2020). Regarding the respondents' demographic data, this study shows that farmers' behavior is not strongly correlated with farmers' education or background. Information regarding pesticides could be learned by interacting with retailers or communicating with co-farmers.

Pesticides should be applied according to field conditions (Tudi *et al*., 2021). The fact that farmers still undertake this activity by group makes it necessary to inform the farmers about the possibility that it will happen, as well as both the positive and negative impacts. The more harmful pesticides should be more expensive. However, in many cases, farmers should deal with some inconvenient conditions regarding the long-term advantages of alternative and safe methods, especially given the widespread availability of inexpensive pesticides (Sarkar *et al*., 2021). Regulation is needed to provide sound educational and policy strategies in order to avoid the dangers of pesticides and reduce their negative potential by polluting agricultural systems (Istriningsih *et al*., 2022).

4. Conclusion

This research was conducted to determine farmers' knowledge level about the use of pesticides to control pests and plant diseases. The primary factor that influenced the selection of pesticide use was the characteristics of farmers. The farmer age in Tulungrejo Village is 56% between 30-50 years old. Most did not have a high educational level; 48% of the farmers only finished their elementary school, 14% finished junior high, 30% finished senior high, and 8% still needed to complete elementary school. Based on this result, the farmers in Tulungrejo Village mostly know about pesticides but do not know how dangerous pesticides are. Most farmers must know that pesticide utilization should be considered the last resort in pest and disease management within the Integrated Pest Management (IPM) framework. Many farmers still think that every pest or disease attack must be sprayed immediately and that pesticides must be sprayed every week. Even though pesticides do not have to be applied every week, attention must be paid to the economic threshold and the intensity of pest or disease attacks. Based on the results, implementing an education and training initiative focusing on Integrated Pest Management (IPM) and pesticide application will help farmers enhance their knowledge and expertise.

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