International Journal of Biological Engineering and Agriculture
ISSN: 2833-5376
Volume 03 Number 03 (2024)
Impact Factor: 9.51
SJIF (2023): 3.916

www.inter-publishing.com

Article

Safety and Techniques for Pesticide Application on Horticultural Plants in Tanjung Pering Village

Oktaviani[1] , Dinda Putri Valentine[1], Diva Ramadona[1]

1. Program Studi Proteksi Tanaman, Jurusan Hama dan Penyakit Tumbuhan, Fakultas Pertanian, Universitas Sriwijaya
* Correspondence: oktaviani@unsri.ac.id

Abstract: Production factors to achieve greater yields. However, the use of pesticides in this agricultural practice raises concerns regarding safety and application techniques. This study examines pesticide safety and application techniques on horticultural crops in Tanjung Pering Village. The research aims to evaluate pesticides' active ingredients, safety, and application techniques. Data collection methods involve direct observation, discussions, and interviews with farmers in Tanjung Pering Village. Primary data were obtained through direct interviews, while secondary data were gathered from various relevant sources. The results indicate that farmers use various pesticides with diverse active ingredients, such as Lamda cyhalothrin, Cypermethrin, Mefenoxam, and Mancozeb. However, pesticide application practices must meet expected safety and efficiency standards. Farmers' understanding of dosage, the use of personal protective equipment (APD), and application techniques still need improvement. In conclusion, more intensive education and awareness campaigns on safe and effective pesticide use are needed to enhance farmers' awareness and practices. Recommendations include a better understanding of dosage, using complete APD, and avoiding pesticide mixing without adequate knowledge to prevent pest resistance and potential hazards for farmers.

Keywords: Pesticide, Horticulture, Crop rotation, Safety, Application techniques

Citation: Oktaviani, Dinda Putri Valentine, Diva Ramadona1. Safety and Techniques for Pesticide Application on Horticultural Plants in Tanjung Pering VillageInternational Journal of Biological Engineering and Agriculture 2024, 3(3), 276-282

Received: 11th July 2024
Revised: 15th July 2024
Accepted: 19th July 2024
Published: 25th July 2024

1. Introduction

The intercropping system, which is a cropping method where two or more types of plants are planted simultaneously on the same land, was described as a way to optimally utilize production factors owned by farmers, including more efficient use of fertilizers and pesticides, reducing erosion, and stabilizing soil biology [1]. Interactions between each plant in an intercropping system were caused by the intercropping of two types of plants. Considerations such as spacing, plant population, harvest age, and plant architecture were required to ensure that sufficient space was provided to maximize cooperation and minimize competition [2].

The bitter melon plant (Momordica charantia L), known for its commercial value when cultivated on a large scale, was identified as a vine originating from Asia. Over time, varieties with superior taste and appearance have been produced. The products of bitter melon plants, which can yield 10-12 fruits per plant or 10-15 tonnes per hectare, have become popular among consumers and entered many supermarkets. The soil conditions

of the land used in cultivating vegetable crops, especially bitter melon, were noted to significantly influence the growth of plants and microorganisms in the soil [3].

Long beans (Vigna unguiculata L.), plants originating from West Africa and widely cultivated in various regions including Southeast Asia, China, Europe, Oceania, and North America, were highlighted for their high consumption frequency in Indonesia, where they are consumed 2-3 times per week either raw or cooked [4]. Long beans were recognized for their health benefits, including regulating the body's metabolism, increasing intelligence, boosting body resistance, and facilitating the digestive process due to their high fiber content. The creeping type of long beans, which twine around stakes and produce fruit approximately 40-70 cm long, was the type most widely cultivated [5]. This research aims to determine what active ingredients are contained in pesticides, their safety, and the application techniques used in Tanjung Pering Village.

2. Materials and Methods

An observation was conducted on horticultural planting land during 2 month (Februari-March) at 9 AM until completion in Tanjung Pering, North Indralaya, Ogan Ilir Regency, South Sumatra Province (Figure 1a and 1b). Discussions and interviews were conducted directly with the farmers in Tanjung Pering Village, Indralaya. It was done to gather information about the pesticides used by farmers, their application, and the safety or effects of these pesticides. The targets of this observation were insects such as fruit flies and aphids on bitter melon and long bean plants, which were planted using an intercropping system. The pesticides used included Sidametrin 50 EC, Matarin 50 EC, and the fungicide Ridomil Gold MZ 4/64 WG. Documentation, including photos and videos, was carried out to support the accuracy and optimal presentation of the information obtained. Primary data was collected through direct interviews and discussions with farmers to deepen knowledge about pesticide use and application techniques. Secondary data was obtained from various references, reports, literature, or previous research to support and complete the primary data and report writing.

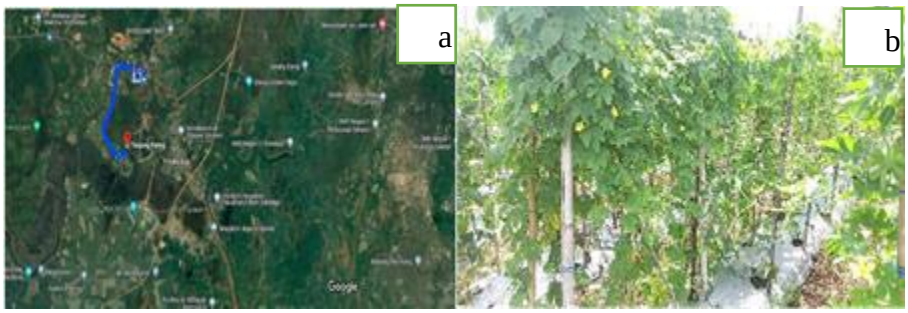

Figure 1. Location of land from Sriwijaya University to Tanjung Pering, Indralaya (a), Observed land (b).

3. Results and Discussion

The results obtained from observations in the intercropping land for bitter melon and long bean plants are as follows Figure 2:

Figure 2. Pesticides used on agricultural land (a), The process of spraying onto plants (b).

Based on the results of observations, it was found that the pesticides used in intercropping areas of bitter melon and long beans were insecticides with the active ingredients Lamda cyhalothrin 25 g/l, Cypermethrin 50 g/l, and fungicides with the active ingredients Mefenoxam 4% and Mancozeb 64% (Table 1). In the intercropping areas of bitter melon and long bean plants, many fruit flies (Bactrocera dorsalis), armyworms (Spodoptera litura), and javelins (Epilachna sparsa) were found. Diseases that can attack or damage bitter melon plants are powdery mildew, anthracnose, wilt, and others. Pests that are often found on long bean plants are black ladybugs (Brachyplatys sp.), grasshoppers (Oxya sp.), and armyworms (Spodoptera litura). Apart from pests, the Bean Common Mosaic Virus (BCMV) and Mungbean Yellow Mosaic Virus (MYMV) were also found. The tools and materials used in this study included a magnifying glass for detailed pest identification, a field notebook for recording observations, pesticide sprayers, and protective gear for safety [6]. Accurate measurements and observations were crucial for assessing the pest and disease pressure in the intercropping system [7].

Table 1. The pesticide used on farmers' land in Tanjung Pering Village.

No	Active ingredients	OPT target	Plants target	Time/ rules for use
1.	Lamda cyhalothrin 25 g/l	Armyworms, grasshoppers, feather caterpillars, spanworms and stem borers.	Food crops (wheat, corn), and so on such as red onion, palm oil and cocoa.	If the population or intensity of attacks has reached the economic threshold. How to use: high volume spraying.
2.	Cypermethrin 50g/l	Insects Fruit flies (*Bactrocera dorsalis*), pest on fruit, armyworms, leaf caterpillars, leafhoppers and seed flies.	corn plants, cocoa, soybeans, cabbage, mustard greens, tea and tobacco.	If the population or intensity of attacks has reached the economic threshold. How to use it can be done by spray high volume.

3.	Mefenoxam 4%	Prevent and stop the spread of *Phytopthora citrophthora* bladder disease.	Citrus plants, cocoa, potatoes, melons and tomatoes	In applying this fungicide applied when the disease appears or in the growth phase of the disease. How to use it can be done by spray fungicide on the leaves and roots of the plant.
4.	Mancozeb 64 %	Control tuber rot disease.	Citrus plants, cocoa, potatoes, melons and tomatoes	In the application of this fungicide, it is applied at the time of disease mergence or growth phase of the disease. How it works, it can be used by spraying fungicide on the leaves and roots of the plant.

Lambda-cyhalothrin is a pyrethroid insecticide introduced in 1988; this insecticide can control various pests such as aphids, Colorado beetles, and thrips. Symptoms of Lambda-cyhalothrin attack began to appear on the first day after application, characterized by the larvae starting to soften and not move. It can happen because Lambda-cyhalothrin is a contact and stomach poison in the form of a clear straw yellow concentrate, which can be emulsified to control insect larvae. Lambda-cyhalothrin is a synthetic pyrethroid insecticide, which is a chemical synthetic ingredient from the poison in the pyrethrum plant [8]. The insecticide is a clear straw yellow concentrate, which must be emulsified for use. Standard tools for measuring its application include calibrated sprayers, which ensure even distribution. Key materials include the Lambda-cyhalothrin concentrate, emulsifying agents, and water for dilution [9]. The recommended concentration typically ranges between 0.5 to 1 liter per hectare, depending on pest severity. Protective gear, such as gloves and masks, is essential for safe handling. The effectiveness of the application is monitored through regular field inspections. These inspections help determine if additional treatments are necessary to maintain pest control [10].

Cypermethrin is a synthetic pyrethroid insecticide that has toxic effects and can harm humans. Cypermethrin is generally used to control pests in agricultural activities. Cypermethrin can also control industrial insects, household pests, and pests in food storage [11]. Cypermethrin with the dosages 5 and 20 mg/kg/day can produce mild to moderate toxic symptoms in the target organism. Applications can be applied in the morning before 9 o'clock or afternoon after 4 o'clock. Spraying is done on a sunny day and is predicted to not rain after 4-6 hours. Pesticides containing Cypermethrin can be used by mixing field water with pesticides. So that there is no mud and sand, the water can be waited or settled one night before spraying so that the mud and other dirt settles.

However, using pesticides containing the active ingredient Cypermethrin, if used continuously, can reduce insect pests and natural enemies. Furthermore, it is crucial to consider the impact on non-target organisms, such as beneficial insects and pollinators. Implementing integrated pest management (IPM) strategies can help balance the use of chemical controls with biological methods [12]. Monitoring and adhering to recommended application rates can also minimize ecological disruption. Additionally, educating farmers and applicators on proper usage and safety measures is essential [22]. Overall, sustainable practices must be prioritized to ensure long-term agricultural productivity and environmental health [13].

Mefenoxam 4% is a metalaxyl fungicide used as a seed treatment. This fungicide can be applied to the soil using the seed treatment method (application to seeds) and by spraying on leaves. Mefenoxam can be used to control downy mildew [14]. When using the active ingredient mefenoxam, it is recommended to wear a face covering, rubber boots, head covering, or hat, and it is not permitted to eat, drink, or smoke and sprayed in the direction of the wind to prevent the spray from being inhaled or exposed repeatedly for a long time. After applying pesticides containing the active ingredient mefenoxam, wash your hands with water and soap until clean. Do not enter the newly sprayed planting area unless you wear protective clothing[23]. Used mefenoxam containers must be washed thoroughly, planted in the ground, and not reused. In addition to its primary use in controlling downy mildew, mefenoxam is effective against other oomycete pathogens such as Phytophthora and Pythium species. Its systemic action allows it to be absorbed by the plant and translocated to various parts, providing comprehensive protection. Research has shown that mefenoxam has a relatively low environmental impact compared to other fungicides, making it a preferred choice for integrated pest management programs [15]. However, the development of resistance in target pathogens is a growing concern, necessitating careful management and rotation with other fungicides. Studies indicate that mefenoxam is most effective when used as part of a broader disease management strategy, including crop rotation and resistant cultivars[24]. The compound's effectiveness can be influenced by soil pH and organic matter content, with optimal performance observed in well-drained soils. Furthermore, it has a low acute toxicity to mammals, but precautionary measures are essential to mitigate potential risks to human health. Ongoing research aims to refine application techniques and enhance the efficacy of mefenoxam while minimizing its environmental footprint [16][25].

Mancozeb 64% is a dithiocarbamate fungicide, which is more efficiently used to eradicate fungi. Mancozeb fungicide is effective for controlling tuber rot disease in storage. Apart from being used to control disease, mancozeb can also increase the percentage of growth and growth of plant seeds. Seed treatment by soaking in mancozeb liquid can produce more excellent germination, root length, stem length, and vigor index than those without mancozeb treatment [17][26]. Even though pesticides have many advantages, such as quickly reducing pest populations, being easy to use, and being economically profitable, the community increasingly feels the negative impacts of their use. It will hurt the environment in the future. Additionally, the potential for pesticide residues to contaminate water sources raises concerns about human and animal health [18][27]. Therefore, while mancozeb offers significant agricultural advantages, it is crucial to balance its use with sustainable farming practices. Integrating mancozeb with organic methods and monitoring its application can help mitigate its negative effects on the environment [19][28].

Safe control other than using insecticides or fungicides to control pests and diseases in bitter melon and long bean plants by pruning the affected leaves. The second way is to find and catch insect eggs and larvae directly and then destroy them. The third is using natural enemies by planting refugia plants, which can become food for predatory adults, and parasitoids that eat nectar or pollen from refugia plants[29]. Another way to use technical culture is to carry out crop rotation. Disease control can be done by rotating crops

on the same land, reducing humidity caused by poor drainage, not planting plants too close together or adjusting plant spacing, taking plants or uprooting them, and then destroying them so they do not spread to other plants [20], [21]. Destruction can be done by burying the plant or by burning it. Another way is to select seeds. It must be ensured that the seeds or seedlings to be planted do not contain disease[30].

4. Conclusion

The pesticides are available in various types, concentrations, and different ingredients. The dose that had been applied must be complied with by pesticide users to prevent harm to those who are not the primary targets, as toxins can be caused by pesticides that can attack through contact, inhalation, or ingestion.

REFERENCES

[1] G. R. Warman and R. Kristiana, "Mengkaji Sistem Tanam Tumpangsari Tanaman Semusim," *Proceeding Biol. Educ. Conf.*, vol. 15, no. 1, 2018.

[2] dan sri utami L. Surtimah, neng susi, "Optimasi lahan dengan sistem tumpang sari jagung manis (zea mays saccharata, sturt) dan kangkung sutra (ipomea reptans) di pekanbaru oleh," *J. Ilm. Pertan.*, vol. 12, no. 2, 2016.

[3] W. Gunadi, K. Sulandjari, and M. Syafi'i, "Respon Pertumbuhan dan Hasil Tanaman Pare (Momordica Charantia L) Varietas Lipa F1 pada Berbagai Taraf Ketebalan Mulsa Jerami Padi," *J. Agrotek Indones.*, vol. 2, no. 6, 2021.

[4] N. A. Azka and R. S. Sayekti, "KARAKTERISASI AKSESI KACANG PANJANG (Vigna unguiculata subsp. sesquipedalis) LOKAL," *Agrotechnology Innov.*, vol. 3, no. 2, 2020, doi: 10.22146/a.62709.

[5] B. Zaevie, Marisi Napitupulu, and Puji Astuti, "Respon Tanaman Kacang Panjang (Vigna sinensis L.) Terhadap Pemberian Pupuk NPK Pelangi dan Pupuk Organik Cair Nasa," *J. AGRIFOR*, vol. 13, no. 1, 2014.

[6] W. J. Lamont, "Pests of the Garden and Small Farm. A Grower's Guide to Using Less Pesticide," *Horttechnology*, vol. 9, no. 4, 2018, doi: 10.21273/horttech.9.4.693.

[7] C. Li *et al.*, "Limited environmental and yield benefits of intercropping practices in smallholder fields: Evidence from multi-source data," *F. Crop. Res.*, vol. 299, 2023, doi: 10.1016/j.fcr.2023.108974.

[8] E. Candra, I. S. Santi, and E. N. Kristalisasi, "Efektifitas Penggunaan Bacillius Thuringiensis dan Landa Sihalotrin pada Ulat Api," *J. Agromast*, vol. 3, no. 1, 2018.

[9] K. Gunewardena and S. Madugalla, "Efficacy of Selected Granular Insecticides for the Control of Maize-Stem Borer (Chilo partellus) (Lepidoptera: Pyralidae)," *Trop. Agric. Res. Ext.*, vol. 14, no. 1, 2012, doi: 10.4038/tare.v14i1.4835.

[10] O. M. Azeez, "Evaluation of Pesticide Application Equipment Efficiency for Pests Control and Safety of the users, a Review," *J. Exp. Agric. Int.*, 2021, doi: 10.9734/jeai/2021/v43i530690.

[11] N. Amir, E. Suprayitno, H. Hardoko, and H. Nursyam, "Pengaruh Sipermetrin Pada Jambal Rotiterhadap Kadaru Reum dan Kreatinin Tikus Wistar (Rattus norvegicus)," *PERENNIAL*, vol. 2, no. 3, 2015.

[12] B. P. Baker, T. A. Green, and A. J. Loker, "Biological control and integrated pest management in organic and conventional systems," *Biological Control*, vol. 140. 2020. doi: 10.1016/j.biocontrol.2019.104095.

[13] G. D. Gann *et al.*, "International principles and standards for the practice of ecological restoration. Second edition," *Restor. Ecol.*, vol. 27, no. S1, 2019, doi: 10.1111/rec.13035.

[14] E. Wulandari, J. Prasetyo, M. Nurdin, and T. Maryono, "PENGARUH MEFENOKSAM DAN Trichoderma sp. TERHADAP PENYAKIT BULAI DAN PERTUMBUHAN TANAMAN JAGUNG," *J. Agrotek Trop.*, vol. 10, no. 1, 2022, doi: 10.23960/jat.v10i1.5601.

[15] J. González-Tobón *et al.*, "Is the phenomenon of mefenoxam-acquired resistance in phytophthora infestans universal?," *Plant Dis.*, vol. 104, no. 1, 2020, doi: 10.1094/PDIS-10-18-1906-RE.

[16] I. Corkley, B. Fraaije, and N. Hawkins, "Fungicide resistance management: Maximizing the effective life of plant

protection products," *Plant Pathology*, vol. 71, no. 1. 2022. doi: 10.1111/ppa.13467.

[17] T. Suharti, Y. Bramasto, and N. Yuniarti, "Pengaruh Pemberian Trichoderma sp. Pada Media Tanam Dan Mankozeb Terhadap Persentase Tumbuh Dan Pertumbuhan Bibit Jabon Merah (Anthocepalus macrophyllus)," *Perbenihan Tanam. Hutan*, vol. 6, no. 1, 2018.

[18] N. S. Singh, R. Sharma, T. Parween, and P. K. Patanjali, "Pesticide contamination and human health risk factor," in *Modern Age Environmental Problems and their Remediation*, 2017. doi: 10.1007/978-3-319-64501-8_3.

[19] R. I. Bwala, H. I. M. Gaya, F. U. Richard, and J. B. Ndirmbula, "Evaluation of Varying Rates of Mancozeb fungicide and Some Plant Leaf Powders as Seed Treatment and their cost-benefit for the Management of Early Leaf Spot (Cercospora arachidicola Hori) Disease of Groundnut in Makurdi, Nigeria," *Sch. Acad. J. Biosci.*, vol. 9, no. 11, 2021, doi: 10.36347/sajb.2021.v09i11.001.

[20] M. A. Spencer, *Pythium irregulare. [Descriptions of Fungi and Bacteria]*. 2005.

[21] P. Narayanasamy, "Cultural Practices Influencing Biological Management of Crop Diseases," in *Biological* Management of Diseases of Crops, 2013. doi: 10.1007/978-94-007-6377-7_2.

[22] M. ÇETİN, H. DURAN, and A. TANER, "PESTICIDE APPLICATION TECHNIQUES IN PRECISION AGRICULTURE," BOOK OF, [Online]. Available: https://www.researchgate.net/profile/Cenk-Kilic/publication/364387571_EFFECTS_OF_DROUGHT_STRESS_ON_PURSLANE_PORTULACA_OLERACEA/links/639ef29740358f78ebfd93b4/EFFECTS-OF-DROUGHT-STRESS-ON-PURSLANE-PORTULACA-OLERACEA.pdf#page=687

[23] B. Greer, O. Chevallier, B. Quinn, L. M. Botana, and ..., "Redefining dilute and shoot: The evolution of the technique and its application in the analysis of foods and biological matrices by liquid chromatography mass …," TrAC Trends in Analytical …, 2021, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0165993621001072

[24] M. E. I. Badawy, M. A. M. El-Nouby, P. K. Kimani, L. W. Lim, and ..., "A review of the modern principles and applications of solid-phase extraction techniques in chromatographic analysis," Analytical …, 2022, doi: 10.1007/s44211-022-00190-8.

[25] M. Faraji, Y. Yamini, and M. Gholami, "Recent advances and trends in applications of solid-phase extraction techniques in food and environmental analysis," Chromatographia, 2019, doi: 10.1007/s10337-019-03726-9.

[26] V. Stejskal, T. Vendl, R. Aulicky, and C. Athanassiou, "Synthetic and natural insecticides: Gas, liquid, gel and solid formulations for stored-product and food-industry pest control," Insects, 2021, [Online]. Available: https://www.mdpi.com/2075-4450/12/7/590

[27] I. A. Saleh, N. Zouari, and M. A. Al-Ghouti, "Removal of pesticides from water and wastewater: Chemical, physical and biological treatment approaches," Environmental Technology &Innovation, 2020, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2352186420313262

[28] C. M. Raffa and F. Chiampo, "Bioremediation of agricultural soils polluted with pesticides: A review," Bioengineering, 2021, [Online]. Available: https://www.mdpi.com/2306-5354/8/7/92

[29] A. L. Souto, M. Sylvestre, E. D. Tölke, J. F. Tavares, and ..., "Plant-derived pesticides as an alternative to pest management and sustainable agricultural production: Prospects, applications and challenges," Molecules, 2021, [Online]. Available: https://www.mdpi.com/1420-3049/26/16/4835

[30] M. Mubushar, F. O. Aldosari, M. B. Baig, B. M. Alotaibi, and ..., "Assessment of farmers on their knowledge regarding pesticide usage and biosafety," Saudi journal of …, 2019, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1319562X1930035X