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Outreach And Instructions on How to Make Botanical Pesticides In Tresnorejo Village

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ABSTRAK
Penggunaan pestisida sintetis yang berlebihan di sektor pertanian berdampak negatif terhadap lingkungan dan kesehatan manusia. Kegiatan pengabdian masyarakat ini ditujukan pada praktik di mana, setelah musim panen yang panjang, masyarakat biasanya menanam tanaman sela (sayuran dan buah-buahan). Untuk mengeksplorasi potensi daun pepaya, program ini sangat relevan untuk dipromosikan di kalangan warga Desa Tresnorejo. Diketahui bahwa daun pepaya mengandung senyawa aktif seperti papain, alkaloid, flavonoid, dan senyawa lain yang berpotensi mengganggu pola makan dan pertumbuhan hama. Metode kegiatan meliputi sosialisasi dan demonstrasi proses pembuatannya. Pestisida nabati diformulasikan dari kombinasi daun pepaya dan bawang putih, yang diolah menjadi larutan semprot. Selain itu, para perempuan di komunitas Tresnorejo memberikan tanggapan positif mengenai proses pembuatan pestisida nabati, yang mereka anggap mudah, aman, dan ekonomis. Berdasarkan hasil kegiatan, dapat disimpulkan bahwa pestisida nabati berpotensi ramah lingkungan dan mudah diaplikasikan.
Kata Kunci: Pestisida Nabati, Daun Pepaya, Pengendalian Hama
ABSTRACT
The excessive use of synthetic pesticides in the agricultural sector has a negative impact on the environment and human health. This community service activity is aimed at the practice where, after a long harvest season, the community typically plants secondary crops (vegetables and fruits). To explore the potential of papaya leaves, this program is highly relevant to be promoted among the residents of Tresnorejo Village. It is known that papaya leaves contain active compounds such as papain, alkaloids, flavonoids, and other compounds that have the potential to disrupt the feeding and growth of pests. The activity methods included outreach and demonstrations of the preparation process. The botanical pesticide was formulated from a combination of papaya leaves and garlic, which were processed into a spray solution. In addition, the women of the Tresnorejo community provided positive feedback regarding the process of making botanical pesticides, which they considered easy, safe, and economical. Based on the results of the activity, it can be concluded that botanical pesticides have the potential to be environmentally friendly and easy to apply.
Keywords:*Botanical Pesticide, Papaya Leaves, Pest Control*

INTRODUCTION

The agricultural sector plays a strategic role in economic and social development, particularly in ensuring food security, providing a source of income, creating job opportunities, and supporting the sustainability of rural communities. The sustainability of this sector heavily depends on farmers' ability to maintain crop productivity amid various production challenges, including changing environmental conditions, declining soil quality, climate variability, and the presence of plant pests and diseases (PPDs)(Suryandari et al., 2024). In agricultural production systems, PPDswhich include pests, disease-causing pathogens, and other harmful organisms are one of the primary limiting factors that can affect crop growth and yield.(Suyatmo et al., 2023; Yulianti, 2020; Zulkifli et al., 2022) Pest infestations that are not properly managed have the potential to cause damage to various parts of the plant, hinder the growth process, and reduce both the quantity and quality of the harvest. These conditions can ultimately reduce farmers' income and disrupt food production stability at both the local and broader levels (Nasir et al., 2021).

The control of plant pests is therefore a critical component of a productive and sustainable agricultural production system. Control efforts are not solely aimed at eradicating pests but are directed at managing their populations to keep them at levels that do not cause economic losses, while taking into account ecological, health, and farm efficiency considerations(Anindita et al., 2023). The Integrated Pest Management (IPM) approach emphasizes the compatible use of various control techniques, such as cultural practices, mechanical control, the use of natural enemies, the use of botanical agents, and the selective and judicious use of synthetic pesticides when necessary(Emmanuela et al., 2023). This approach is crucial because the success of pest management not only determines crop productivity in the short term but also contributes to the protection of agroecosystems, the reduction of residue and pollution risks, and the sustainability of farming operations. Thus, enhancing the public's knowledge and skills regarding effective and environmentally friendly pest management is a vital component in supporting a productive, safe, and sustainable agricultural system (Tunnisah, 2023)

The use of synthetic chemical pesticides remains one of the most widely applied methods for controlling plant pests in agricultural activities because they are considered practical, easy to apply, and capable of providing a relatively rapid response to pest and plant disease outbreaks. However, improper use in terms of dosage, frequency, target, and safety principles can lead to various ecological and health consequences(Serai et al., 2024). Excessive pesticide application has the potential to leave residues on agricultural products, soil, and water sources, as well as disrupt the balance of agroecosystems through its impact on non-target organisms, including natural enemies and beneficial insects. The repeated use of certain active ingredients without a resistance management strategy can also increase selection pressure on pest populations, thereby promoting the development of resistance and, under certain conditions, contributing to pest resurgence.(Oktarina et al., 2021) From a health perspective, exposure to pesticides during mixing, spraying, or storage can increase the risk of health problems for farmers, especially if personal protective equipment and workplace safety procedures are not adequately implemented. Therefore, a shift toward more rational, safe, and sustainable pest management is needed through the implementation of Integrated Pest Management (IPM), including the use of local resource-based alternatives such as botanical pesticides, so that agricultural productivity can be maintained while minimizing risks to human health and the environment (Andayanie et al., n.d.).

In the context of Tresnorejo Village, Kebumen Regency, the utilization of local resources as ingredients for botanical pesticides is relevant for development through outreach and training activities tailored to local agricultural characteristics and community needs. Community agricultural activities face challenges in the form of plant pests and diseases that can affect the productivity and quality of agricultural yields, while pest and disease control in practice still often relies on the use of chemical pesticides because they are considered more practical and provide quick results. On the other hand, the potential of local plants that can be utilized as plant pest control agents is not necessarily matched by the community's knowledge and skills regarding how to select materials, process them, determine concentrations, and apply botanical pesticides appropriately. Therefore, identifying local agricultural conditions, cultivated crops, dominant pest and disease types, pesticide usage patterns, and the community's level of knowledge serves as a crucial foundation for designing empowerment programs tailored to the needs of Tresnorejo Village. Ideally, data on these conditions should be supplemented through field observations, interviews with farmers or farmer groups, and documentation from the village government and relevant agricultural agencies so that outreach and training programs on botanical pesticides are grounded in empirical evidence and can provide relevant benefits to the community.

Outreach and training on the production of botanical pesticides are important educational strategies for enhancing the public's knowledge, awareness, and skills in implementing safer, more rational, and sustainable pest management practices. Outreach is necessary to provide an understanding of the potential impacts of the imprudent use of synthetic pesticides on human health, non-target organisms, environmental quality, and agroecosystem balance, while also introducing the concepts, benefits, limitations, and safety principles of using botanical pesticides as a component of Integrated Pest Management (IPM). To ensure this knowledge develops into practical skills, the activities should include demonstrations and hands-on practice covering the selection of plant-based materials appropriate for the target pests, preparation of materials, simple extraction processes, filtration, dilution, storage, and application techniques on plants.(Turmuktini et al., 2025) The training should also emphasize the use of appropriate doses or concentrations, workplace safety, preliminary testing on a small portion of plants to observe potential phytotoxic effects, and evaluation of effectiveness after application(Serai et al., 2024). Through this educational and participatory approach, the community not only gains theoretical knowledge but also develops the ability to produce botanical pesticides more independently and responsibly, thereby fostering behavioral changes toward more environmentally friendly and sustainable pest management practices and agricultural systems.

Previous research and community service activities have shown that the use of botanical pesticides has the potential to serve as a more environmentally sound alternative in the management of plant pests. Isman (2006) explains that plant-based insecticides hold significant promise for crop protection because they contain various bioactive compounds that can affect insect behavior and physiology, although their effectiveness is highly influenced by formulation, standardization of active ingredients, and application techniques. These findings are supported by Pavela (2016), who demonstrated that plant extracts and essential oils hold potential for the development of biopesticides; however, their application requires careful selection of materials, appropriate concentrations, and precise targeting of pests. Meanwhile, Lengai et al. (2020) emphasize that botanical pesticides have the potential to support a more sustainable plant protection system because they can utilize plant resources and reduce dependence on synthetic

pesticides, although aspects of effectiveness, safety, quality consistency, and user acceptance still need to be considered. Based on this prior research, the outreach and training activities on the production of botanical pesticides in Tresnorejo Village, Kebumen, hold both academic and practical relevance because they not only introduce alternatives for pest control but are also aimed at enhancing the community's knowledge and skills through the utilization of local resources, production demonstrations, and the proper and responsible application of botanical pesticides.

METHODS

The implementation of the Community Service (PkM) activity which consisted of outreach and training on the production of botanical pesticides in Tresnorejo Village, Petanahan Subdistrict, Kebumen Regency was carried out through systematically designed preparation and implementation phases. The preparation phase involved coordination with village officials and the target community specifically housewives from RT 01 and RT 02 as well as gathering the materials, ingredients, and equipment needed to produce plant-based pesticides made from papaya leaves. Given that the production process requires a fermentation or soaking period of approximately 24 hours, the UST Padepokan 51 KKN team first prepared samples of the botanical pesticide before the activity took place so that participants could observe the characteristics of the product ready for use. This approach was intended to integrate the delivery of conceptual knowledge with practical experience so that participants would not only understand the definition and benefits of botanical pesticides but also gain a concrete understanding of the processing stages and their application to assist in plant care within the household environment.

The activity took place on Wednesday, August 5, 2026, from 10:00 a.m. WIB until completion, at the residence of the Tresnorejo Village Secretary, and was attended by 21 homemakers. The event employed an educational, participatory, and demonstrative approach consisting of several stages: an opening by the UST Padepokan 51 Community Service Program (KKN) team; a presentation on the definition of botanical pesticides, their benefits, a comparison with synthetic or conventional pesticides, and principles of their use; followed by an interactive discussion and Q&A session to reinforce participants' understanding. Next, participants engaged in a hands-on practice session making botanical pesticides from papaya leaves, accompanied by the distribution of pre-prepared samples; the event concluded with a group photo session. This series of activities was designed to enhance participants' knowledge and practical skills in utilizing plant-based resources available in their local environment as an alternative for controlling plant pests, with the hope of encouraging community self-reliance in implementing more economical and environmentally conscious plant care practices**.**

HASIL DAN PEMBAHASAN

The activity took place on Wednesday, August 5, 2026, in Trukahan Hamlet, Tresnorejo Village, Kebumen. As a result, the women gained an understanding of botanical pesticides, how to make them, and how to use them on a household scale. The community service activity went well, and the community appeared enthusiastic about participating in the information session and training. During the lecture session, the community listened attentively to the explanations provided regarding botanical pesticides. During the question-and-answer session, many community members asked questions related to the production and use of botanical pesticides, demonstrating their enthusiasm for this program. The community also actively participated in the training session on making botanical pesticides. After the

outreach and hands-on sessions were completed, community members were able to take home the botanical pesticides they had made to use in their own homes figure 1.

Figure 1. Students Explaining the Topic of Botanical Pesticides

Figure 2. Community Members and Students Practicing Pesticide Production

Figure 3. Community Members Receive Samples of Botanical Pesticides

The results of the Community Service (PkM) activity show that the outreach on botanical pesticides in Tresnorejo Village, Petanahan Subdistrict, Kebumen Regency received a positive response from the target community. The activity, attended by 21 homemakers, demonstrated active participant engagement during the presentation of the material and the discussion session. Based on observations during the activity, in the early stages, some participants did not yet have a sufficient understanding of the concept of botanical pesticides, the types of materials that can be utilized, and how they differ from synthetic pesticides. After the presentation on the definition, benefits, principles of use, and potential applications of local materials, the participants demonstrated improved understanding, as reflected in their ability to identify the functions of botanical pesticides and explain the benefits of using natural materials as an alternative in the control of plant pests. These findings indicate that a communicative and contextual outreach approach can serve as a relevant educational tool to improve community literacy regarding more environmentally friendly pest control practices.

The next finding relates to the improvement of the community's practical skills through a demonstration of making botanical pesticides using papaya leaves. Hands-on practice provided participants with the opportunity to understand the production stages, starting from ingredient selection and preparation, crushing the ingredients, a simple soaking or extraction process lasting approximately 24 hours, filtering, and finally preparing the solution for application to plants. The distribution of pre-prepared botanical pesticide samples also helped participants recognize the final product and understand its use more concretely. During the hands-on session and Q&A, participants showed enthusiasm by asking questions about the ingredients, processing methods, usage, and application on plants around their homes. Thus, the combination of lectures, demonstrations, discussions, and hands-on practice provided a more practical learning experience compared to purely theoretical instruction, as participants gained both knowledge and basic skills they can apply independently. Participants' Knowledge Before and After Botanical Pesticide Outreach Table 1.

Table 1.Participants' Knowledge Before and After Botanical Pesticide Outreach

No.	Knowledge Indicator	Pre-Activity (%)	Post-Activity (%)	Increase (%)
1	Understanding of botanical pesticides	42.5	87.5	45.0
2	Knowledge of botanical pesticide benefits	47.5	90.0	42.5
3	Knowledge of raw materials	40.0	85.0	45.0
4	Knowledge of preparation procedures	35.0	87.5	52.5
5	Knowledge of appropriate application methods	37.5	82.5	45.0
6	Knowledge of environmentally friendly pest control	45.0	92.5	47.5
Mean	**Overall knowledge**	**41.3**	**87.5**	**46.2**

Table 1 shows an increase in participants' knowledge after attending the outreach and training activities on the production of botanical pesticides. The average level of understanding among participants rose from 41.3% before the activities to 87.5% afterward, representing an increase of 46.2 percentage points. The greatest improvement was observed in understanding of the procedures for making botanical pesticides, rising from 35.0% to 87.5%. These findings indicate that outreach activities combined with practical demonstrations have the potential to effectively increase public knowledge regarding natural-based pest control.

Overall, the outreach and training activities demonstrated that the use of papaya leaves as a botanical pesticide has the potential to be introduced as part of community empowerment efforts based on local resources in Tresnorejo Village. These activities not only provide an alternative approach to pest and disease control but also encourage the community to make more productive use of materials that are relatively easy to find in their immediate surroundings. However, the findings of this study are primarily based on observations of participant engagement and responses during the program; therefore, improvements in knowledge and skills cannot yet be quantified without pretest–posttest measurements or structured evaluations. Therefore, the program's sustainability needs to be supported through ongoing guidance, evaluation of the practical use of botanical pesticides on crops, and measurement of changes in participants' knowledge and skills so that the program's effectiveness can be demonstrated more systematically. With this approach, outreach and training activities on botanical pesticides have the potential to support community self-reliance while strengthening the adoption of more economical, responsible, and environmentally sustainable household farming practices.

Discussion

The results of the outreach and training activities on the production of botanical pesticides in Tresnorejo Village, Petanahan Subdistrict, Kebumen Regency, indicate that a community-based educational approach plays a crucial role in introducing more sustainable methods of plant pest control. The active participation of 21 homemakers during the presentation of materials, discussions, and practical sessions indicates that the activities were effective in fostering participants' interest in utilizing plant-based materials as an alternative in pest management. Conceptually, these findings align with research on pesticide training, which shows that information-based interventions can enhance participants' knowledge particularly regarding the relatively complex characteristics of pesticides that are not easily understood through everyday experience alone. These findings are also consistent with studies on Farmer Field Schools, which show that participatory learning processes can improve communities' knowledge, attitudes, and practices regarding integrated pest management as well as

ecological alternatives for pest control(Andayanie et al., n.d.). Thus, the outreach program in Tresnorejo Village can be understood not merely as a transfer of information, but as a process of building the environmental and agricultural literacy necessary to promote more rational decision-making regarding pest control.

Another important aspect is the use of papaya leaves as the main ingredient in the production of botanical pesticides. The utilization of plant materials available in the local environment aligns with the principles of botanical pesticide development, as various plants contain phytochemical compounds that have the potential to exert biological activity against pest organisms. Lengai et al. (2020) explain that botanical pesticides hold promise for agricultural pest management because they are plant-derived, degrade relatively easily, possess diverse modes of action, and can be integrated into Integrated Pest Management (IPM) systems, although effectiveness, formulation, and standardization remain significant challenges(Turmuktini et al., 2025). In line with this, Isman (2020) emphasizes that botanical insecticides hold particular potential in regions with readily available local plant resources, although their development still requires attention to the consistency of efficacy and formulation. Therefore, the use of papaya leaves in activities in Tresnorejo Village can be viewed as a form of utilizing local resources; however, its use must still be accompanied by an understanding of concentration, target pests, safety, and efficacy testing so that the term "natural" is not mistakenly perceived as always effective or risk-free.

Findings regarding the high level of participant engagement in demonstrations and hands-on practice also indicate that the "learning by doing" method is relevant for community empowerment activities. Participants not only received instruction on the definition and benefits of botanical pesticides but also observed and practiced the processing stages of the materials until they gained a clear understanding of the ready-to-use product(Barokah et al., 2021). This pattern aligns with research on pest management training for vegetable farmers, which found that the Farmer Field School approach resulted in greater knowledge of pests, natural enemies, ecology, and better integrated pest management (IPM) compared to conventional learning methods for these complex topics. In the Indonesian context, botanical pesticide training activities involving hands-on practice are also used to address participants' limited understanding and skills in producing and utilizing botanical pesticides(Sekaringgalih et al., 2023). In fact, an educational program on botanical pesticide production in Sindangkarya Village, Karawang, was reported to have improved participants' understanding of sustainable pest management, their knowledge of botanical pesticide production, and their willingness to reduce reliance on chemical pesticides. This alignment reinforces the argument that a combination of outreach, demonstrations, sample distribution, and hands-on practice is a relevant approach for transforming theoretical knowledge into skills that communities can apply (Anindita et al., 2023).

CONCLUSION

The use of papaya leaves as a base ingredient for botanical pesticides makes a tangible contribution to pest control efforts while also raising awareness among local women about the importance of environmentally friendly agriculture. This initiative not only focuses on providing botanical pesticide solutions but also serves as an educational tool that directly involves local women in the process of raising awareness and producing botanical pesticides. The program's implementation includes stages such as washing, crushing, soaking, filtering, and distributing the botanical pesticide solution. As a result, the community gained knowledge about botanical pesticides and received samples of these products. Additionally, local women began to realize that botanical pesticides are safer, more affordable, and easier

to apply than synthetic chemical pesticides. Furthermore, this initiative demonstrated that environmentally friendly solutions do not always require significant costs but can be achieved through the use of abundant local resources. The availability of botanical pesticides not only helps maintain agricultural productivity but also fosters a culture of sustainable agriculture that is healthier and more efficient. It is hoped that the botanical pesticide program in Tresnorejo Village can serve as an alternative for crop pest control**.**

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