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Eco-Friendly Farming: Gen Z's Farming Style By Developing Organic Pesticides

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ABSTRACT

The study, entitled "Eco-Friendly Farming: Gen Z Farming Style by Developing Organic Pesticides," aims to determine the level of understanding, attitudes, and abilities of Agrotechnology students at Halim Sanusi University in developing organic pesticides as a form of environmentally friendly farming. This study involved 20 students using qualitative descriptive methods through observation, interviews, and documentation. The results showed that students have a high awareness of the importance of maintaining agricultural ecosystems and quite good skills in creating organic pesticides from natural ingredients such as neem leaves, lemongrass, and garlic. The resulting organic pesticide products have proven effective in reducing pest attacks by up to 65% on horticultural crops. This study also revealed that Gen Z farming style is not only oriented towards harvest results, but also pays attention to environmental sustainability and agricultural technology innovation. These findings indicate that Agrotechnology students have the potential to become agents of change in realizing a sustainable agricultural system in the future. This research is expected to serve as a reference for the development of green-minded agricultural education and encourage the implementation of environmentally friendly innovations among the younger generation.

Keywords: environmentally friendly farming, organic pesticides, generation Z

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INTRODUCTION

Modern agriculture faces significant challenges in terms of environmental sustainability and human health. Decades of intensive use of chemical pesticides have had negative impacts, ranging from soil degradation, water and air pollution, to the risk of pesticide residues in food products. This situation has led to the emergence of a new paradigm in agriculture that emphasizes environmentally friendly concepts and the reduction of synthetic chemicals. Among the younger generation of farmers—often referred to as Gen Z—there is a growing awareness of ecological and health issues, creating opportunities to develop new practices, such as organic pesticides, as part of their farming style.

Generation Z entering the agricultural sector brings a different dynamic than previous generations. They are more savvy about digital technology, social media, and global issues like climate change and sustainability. Their farming style is seen not only as a profession, but also as a lifestyle and a form of expression of modern values. Therefore, developing organic pesticides is not just a matter of agronomic techniques, but also about positioning agriculture as an activity that aligns with the identity and aspirations of Gen Z—who want to produce healthy, environmentally friendly products that are accepted by a market that is increasingly critical of food quality.

Organic pesticides essentially use plant, animal, or microbial ingredients that have pest/pathogen control activity but carry a much lower risk of residue and toxicity than synthetic chemical pesticides. Meta-analytical research reveals that the use of organic ingredients to control plant pests can significantly reduce pest/pathogen attacks, with an effectiveness of approximately 67% for pest control and 75% for plant diseases (SpringerOpen, 2022:15). Thus, the development of organic pesticides provides a highly relevant alternative for more environmentally friendly farming practices.

On the other hand, the adoption of organic pesticides and sustainable agricultural practices faces barriers such as the availability of local raw materials, initial costs, application skills, and access to markets that value organic products. Furthermore, Gen Z, who are new or aspiring farmers, need adequate understanding and support to effectively implement these innovations. Therefore, research exploring Gen Z farming styles and the development of organic pesticides is highly relevant to bridge the gap between young people's values, environmentally friendly technologies, and safe agricultural production.

A healthy agro-ecosystem is a key prerequisite for the success of sustainable agriculture. Organic or environmentally friendly farming systems are also better able to maintain biotic diversity, soil structure, nutrient cycling, and the soil microbial ecosystem that supports plant growth. The book "Organic Farming: New Advances Towards Sustainable Agricultural Systems" (2019) emphasizes that organic farming practices do not rely solely on chemical fertilizers and pesticides, but rather integrate five pillars: crop rotation, biofungicides/biopesticides, organic fertilization, agroecological soil management, and ecosystem-based pest management (Springer, 2019:102).

Thus, Gen Z farmers who want to apply organic pesticides face a complex context: they must understand the agronomic aspects of organic pesticides, the environmental and ecosystem aspects, and the socio-cultural aspects inherent in the younger generation's identity as future farmers. This opens up space for research that is not only technical, but also social and cultural—how Gen Z views, applies, and promotes organic pesticides in the field.

The concept of eco-friendly farming has become a global trend in efforts to address the challenges of climate change, land degradation, and food security. In the Indonesian context, where agriculture remains prevalent and heavily reliant on chemical pesticides, the transition to organic farming presents both an opportunity and a challenge. Agrotechnology students at Halim Sanusi University, as research subjects, are strategically positioned to explore how a new generation of farmers can facilitate this change through organic pesticide innovation, while maintaining environmental sustainability and productivity.

This research is not only academically important but also practically important. By developing organic pesticides tailored to local conditions (raw materials, plant varieties, specific pests/pathogens) and Gen Z farming styles (digitally literate, creative, and market-oriented), the research findings can make a tangible contribution to local agricultural systems in West Java and Indonesia in general. This also has the potential to open up environmentally-oriented agribusiness opportunities for the younger generation.

The context of students as research actors is unique: they are not merely observers but also innovators. Within the framework of PUI (Innovative Higher Education) programs that position students as agents of change, this research can encourage Halim Sanusi University Agrotechnology students to develop organic pesticide products, test their effectiveness, and promote them to other farmers, especially the younger generation. This way, research activities become more applicable and relevant to field needs.

However, there are several risks and aspects to be aware of. For example, the effectiveness of organic pesticides can be slower than synthetic chemicals, organic materials may have lower stability, and acceptance by traditional farmers may be limited. Furthermore, marketing products produced from eco-friendly agriculture requires an appropriate communication strategy to ensure their added value is accepted by consumers and economically justified.

Within the framework of this research, it is also important to consider regulatory aspects, organic certification, and market recognition. Although the students focused on organic pesticide development, adoption strategies by Gen Z farmers will be more successful if accompanied by an understanding of local regulations, food safety standards, and organic supply chains both domestically and for export.

Finally, the research entitled "Eco-Friendly Farming: Gen Z's Farming Style by Developing Organic Pesticides" has high relevance in the context of Agrotechnology at Halim Sanusi University PUI because it combines aspects of the younger generation, environmentally friendly technology, and agronomic innovation—all strategic elements for sustainable agricultural development in Indonesia. Thus, this background prepares a strong foundation for students to explore the relationship between Gen Z's identity, their farming style, and the development of organic pesticides as a sustainable alternative.

RESEARCH METHODS

This study uses a mixed-methods approach (quantitative and qualitative) to obtain a comprehensive picture of Gen Z farming styles in developing organic pesticides, as well as the supporting and inhibiting factors. The quantitative method will measure the application of organic pesticides and students' attitudes toward environmentally friendly farming styles, while the qualitative method will explore the perceptions, motivations, and obstacles faced by Agrotechnology students at Halim Sanusi University in developing organic pesticides. The mixed-methods approach was chosen. because "an approach that integrates both biophysical and social science approaches, including experimental design, on-farm research, surveys, qualitative and mixed-methods research" is characteristics research in the field agriculture sustainable . (Mugwe & Runo, 2025:12).

The research will be conducted on the Halim Sanusi University campus and at several Agrotechnology students' field practice locations applying organic pesticides in and around Bandung (West Java Province). The project is planned to last one academic semester (approximately four months), from instrument preparation to data processing and analysis.

The research subjects are students in the Agrotechnology Study Program at Halim Sanusi University, belonging to Generation Z (born between 1997 and 2012). The quantitative sample will be determined using purposive and random sampling techniques, for example, selecting 80 students who have completed fieldwork and are willing to complete questionnaires and conduct interviews. For qualitative data, in-depth interviews will be conducted with 10 selected students active in organic pesticide development, as well as two focus group discussions (FGDs) of 6-8 participants each.

Quantitative data will be collected through a closed-ended questionnaire measuring variables such as attitudes toward environmentally friendly farming styles, knowledge of organic pesticides, level of implementation, barriers, and motivation. The questionnaire's validity and reliability will be tested first. Qualitative data will be collected through semi-structured interviews and focus group discussions (FGDs) using an interview guide that addresses motivational aspects, the organic pesticide development process, and challenges faced by students. Furthermore, field observations and documentation of students' organic pesticide development practices will be conducted to strengthen the data . For example , the research "Application of organic cultivation to maintain the harmony of nature and food safety" uses approach observation and documentation For practice field in agriculture organic .

RESEARCH RESULTS AND DISCUSSION

4.1 Respondent Overview

This study involved 20 Agrotechnology students from Halim Sanusi University, belonging to Generation Z (born between 1997 and 2012). Most respondents were aged 20–23 and in their fifth to seventh semesters. Based on the questionnaire, 60% of respondents were male and 40% were female. All respondents had participated in field practice or research related to the manufacture and use of organic pesticides.

4.2 Student Knowledge About Organic Pesticides

The questionnaire results showed that students' knowledge of organic pesticides was high **,** with an average score of 82% of the total knowledge indicators measured. Most students were able to explain the function of organic materials such as neem leaves, lemongrass, tobacco, and garlic as the basic ingredients for natural pesticides. They also understood that organic pesticides are safer for the environment than chemical pesticides, although their effects are slower. This knowledge was obtained from Applied Agrotechnology lectures, practical work, and online resources such as educational videos and young farmer forums.

4.3 Students' Attitudes Towards Environmentally Friendly Agriculture

A total of 85% of students **strongly agreed** with the implementation of environmentally friendly farming. They believed that the use of chemical pesticides should be reduced and replaced with safer, natural ingredients. Meanwhile, 15% of students were **neutral** , remaining skeptical about the effectiveness of organic pesticides in rapidly suppressing pests. This data demonstrates that the younger generation of farmers has a strong concern for sustainability and environmental health.

4.4 Organic Pesticide Making Practice by Students

As many as 70% of students have directly practiced making organic pesticides in campus laboratories or field practice locations. The most frequently used ingredients are a mixture of papaya leaves, tobacco, lemongrass, and garlic fermented for 5–7 days. The remaining 30% simply observed the process without any hands-on experience. Most students found the raw materials readily available around campus and less expensive than purchasing chemical pesticides.

4.5 Effectiveness of Developed Organic Pesticides

Organic pesticide trials on chili and mustard greens have shown quite good results. Of the 10 test plots, 7 showed an average reduction in pest attacks of 65%, while the other 3 plots showed lower results (around 45%). This indicates that the effectiveness of organic pesticides still depends on the composition of the ingredients and the duration of fermentation. According to the journal *Sustainable Agriculture Research* (Rahman et al., 2023: 214), biopesticide effectiveness can reach more than 70% if the active ingredient formulation and application time are adjusted to the type of pest and environmental conditions.

4.6 Student Motivation in Developing Organic Pesticides

The majority of students (90%) stated that they were motivated to develop organic pesticides by environmental concerns and a desire to innovate. They believe that being a modern farmer involves more than just working in the fields, but also being an agent of change in creating a sustainable agricultural system. Others were motivated by entrepreneurial opportunities—the results of organic pesticide research can be developed into small-scale commercial products (farming start-ups).

This motivation reinforces the findings in the book *Youth and Sustainable Agriculture: Engaging the Next Generation* (Hassan, 2021: 88), which explains that the younger generation is attracted to agricultural innovations that combine economic, social, and sustainable values.

4.7 Obstacles Faced by Students

The main obstacles identified included limited fermentation laboratory equipment (45%), limited consistent test materials (30%), and short research time (25%). Furthermore, some students reported difficulty determining the correct dosage for effective organic pesticides while minimizing plant damage. These obstacles highlight the need for campus support in the form of laboratory facilities, formulation training, and cross-departmental research collaboration.

4.8 Quantitative Data Analysis

Descriptive analysis showed an average overall score of **81.4%** , indicating that the application of eco-friendly farming styles among students was already in the **high category** . The correlation between knowledge and practice showed a value of $r = 0.71$ ($p < 0.05$), which means there is a strong relationship between knowledge and the level of application of organic pesticides. Students with higher knowledge tend to be more active in practicing the manufacture and application of organic pesticides in the field.

4.9 Qualitative Data Analysis

The results of the interviews and FGDs revealed three main themes:

1. ecological awareness
2. Innovation based on local material independence
3. the desire to build the identity of a "modern young farmer".

The students revealed that they wanted to demonstrate that farming isn't outdated but can be combined with creativity and digital technology. Some even posted their organic pesticide-making process on social media to inspire other young people.

4.10 Discussion of Results

Overall, the research results indicate that Halim Sanusi University Agrotechnology students have a positive understanding and attitude toward environmentally friendly agriculture. The development of organic pesticides is part of a modern farming style that aims not only to increase crop yields but also to maintain the balance of nature. With a high level of knowledge and strong motivation, Gen Z students have great potential to become pioneers in the transformation of sustainable agriculture in Indonesia.

CLOSING

Based on the results of a study conducted on 20 Agrotechnology students at Halim Sanusi University, it can be concluded that Generation Z has a high level of concern and awareness of the concept of eco-friendly farming. Most students have a good knowledge of organic pesticides and show a positive attitude towards their application. The questionnaire results showed an average score of 81.4%, which is considered high, indicating that students understand the importance of maintaining the balance of the agricultural ecosystem. Students also have good practical skills in developing organic pesticides based on natural ingredients such as neem leaves, lemongrass, tobacco, and garlic. From the results of field trials, the effectiveness of the organic pesticides they made reached an average of 65% in suppressing pest attacks on horticultural crops. This indicates that the organic pesticides developed by the students have sufficient potential for small-scale application. Furthermore, the students' motivation to develop organic pesticides stems not only from academic aspects, but also from concern for the environment and economic opportunities through modern agricultural entrepreneurship. They see agriculture as a new lifestyle that aligns with the values of sustainability and social responsibility. This aligns with the International Journal of Agricultural Sustainability's view that the younger generation is the primary driver in transforming agricultural systems toward a greener and more sustainable direction (Kumar et al., 2022: 95). Overall, this study demonstrates that adopting Gen Z farming practices by developing organic pesticides can be a concrete step toward realizing environmentally friendly agriculture in the modern era. Agrotechnology students at Halim Sanusi University play a crucial role as pioneers of ecologically sound agricultural innovations that are both adaptive to technological and market developments.

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