

Effect of Superior Varieties and Insecticides on Pest Control and Food Safety of Groundnut (*Arachis hypogaea* L.)

Prihatin Prihatin^{1✉}, Nurul Wiridannisaa², Tamrin Abdullah³

¹ Study Program of Food Technology, Institut Teknologi Bacharuddin Jusuf Habibie, Indonesia

² Study Program of Agroecotechnology, Agriculture and Forestry Faculty, Universitas Sulawesi Barat, Indonesia

³ Program Study of Plant Protection, Faculty of Agriculture, Universitas Hasanuddin, Indonesia

✉ Corresponding Author : Prihatin Prihatin (e-mail: prihatinsugeng@ith.ac.id)

Article Information	ABSTRACT
Article History Received : March 10, 2025 Revised : April 02, 2025 Published : April 12, 2025	Groundnut (<i>Arachis hypogaea</i> L.) is a vital protein source supporting nutrition and sustainable farming, yet its productivity in Indonesia remains low due to pests and poor cultivation. This study aims to evaluate the effectiveness of a combination of superior varieties and types of insecticides in suppressing pest populations and increasing yields. The research was conducted in Sambueja Village, Maros Regency, using a Randomized Group Design (RAK) with four treatments: A1 (local seed + deltamethrin chemical insecticide), A2 (local seed + bogenvil vegetable insecticide), B1 (Takar 2 + chemical insecticide), and B2 (Takar 2 + vegetable insecticide), each with three replications. Results indicated that treatment B1 gave the highest yields: plant height 45 cm, number of leaves >20, wet weight 287.42 g, and number of pods 286.93 per plant. Treatment B2 was also high: 261.98 g wet weight and 261.49 pods. Treatments with local varieties gave lower yields. The use of improved varieties such as Takar 2, especially in combination with effective insecticides, is proven to increase productivity. However, chemical insecticides risk leaving residues that impact natural enemies, health, and the environment. In contrast, plant-based insecticides, while slower, are an environmentally friendly alternative that supports sustainable and safe agriculture.
Keywords: <i>Food safety;</i> <i>Groundnut;</i> <i>Improved varieties;</i> <i>Insecticides;</i> <i>Pest control</i>	

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a grain legume crop that plays an important role in the agricultural sector and food security in various countries, including Indonesia (Zulfi *et al.*, 2024). Groundnut as a source of vegetable protein not only contributes to the fulfilment of people's nutritional needs but also has a meaningful ecological role in the development of sustainable agricultural systems. Its ability to fix nitrogen through synthesis with *Rhizobium* bacteria in root nodules helps improve soil fertility, thereby reducing dependence on synthetic nitrogen fertilizers (Mahmud *et al.*, 2020; Sapalina *et al.*, 2022). In addition, it supports the diversification of food production and has high economic value due to its rich nutrient content, including protein, vegetable oil, fiber, vitamin E, folic acid, magnesium, and antioxidants that are beneficial for human health (Wahyudi *et al.*, 2020; Kasim *et al.*, 2024).

Despite its great potential, groundnut productivity in Indonesia is still relatively low compared to other major producing countries (Paturohman & Sumarno, 2014; Kurniawan *et al.*, 2017). Some of the factors causing this condition are agronomic challenges faced by farmers, such

as pest attacks and suboptimal cultivation. In addition to biotic factors, abiotic factors such as climate change and land degradation have also been identified as causes of serious yield declines. As a result, groundnut productivity is declining not only in terms of quantity but also in terms of quality, which adversely affects national food security.

To increase groundnut productivity and ensure food security, more effective cultivation strategies must be developed. An important approach is the selection of improved varieties that have better resistance to pests and diseases. Superior varieties, characterized by superior genetic characteristics, have the potential to reduce pest attacks, resulting in more stable and high-quality yields (Kasno & Harnowo, 2014). In addition, the application of effective pest control technology is also a key factor in maintaining crop productivity. One strategy commonly used by farmers is the application of insecticides to suppress pest populations that have the potential to damage crops (Indiati, 2014). However, the unwise use of insecticides can have various negative impacts on both the environment and human health. The accumulation of insecticide residues in crops risks threatening food safety, while environmental pollution due to excessive application can disrupt the balance of the ecosystem. In addition, intensive use of insecticides can trigger pest resistance, which in turn reduces control effectiveness and increases farmers' dependence on synthetic chemicals (Fitriadi & Putri, 2016; Suryani *et al.*, 2020; Sinambela, 2024). Therefore, a more sustainable approach to pest control is needed, such as integrating the use of superior varieties with environmentally friendly control techniques to optimize crop yields without damaging the balance of agricultural ecosystems.

This study aims to evaluate the effectiveness of the combination of the use of superior varieties and various types of insecticides in suppressing pest attacks and maintaining peanut food security. It is expected that the results of this research can provide strategic recommendations for farmers in managing groundnut cultivation more efficiently and sustainably. In addition to supporting increased productivity, this research also contributes to reducing dependence on imports and strengthening national food security by producing safer and higher quality groundnut products.

RESEARCH METHODS

This research was conducted in Sambueja Village, Simbang Sub-district, Maros District, South Sulawesi. The selection of the research location was based on agroecological characteristics that are suitable for groundnut growth as well as a high level of pest infestation that allows optimal evaluation of insecticide effectiveness. The research took place from September 2023 to January 2024, covering the stages of land preparation, planting, maintenance, insecticide application, observation, harvesting, and data analysis.

Experiment Design

This study used a group randomized design (CRD) with four treatments and three replications, resulting in a total of 12 experimental units. Each experimental unit was conducted in a 3.6 m × 3.6 m plot, with a spacing of 30 cm between plants to ensure optimal growing space. The treatments in this study consisted of a combination of two peanut varieties, namely local seeds and takar 2 seeds, and two types of insecticides, namely chemical insecticides made from deltamethrin and vegetable insecticides made from bogenvil leaf extract.

The treatment combination resulted in four test variations, namely: a combination of local seed with chemical insecticide made from deltamethrin 25 EC (A1), a combination of local seed with vegetable insecticide made from bogenvil leaf extract (A2), a combination of takar 2 seed with chemical insecticide made from deltamethrin 25 EC (B1), and a combination of takar 2 seed with vegetable insecticide made from bogenvil leaf extract (B2).

Research Procedures

Land Preparation and Planting. The research land was first processed by hoeing until it reached a loose soil texture. Beds were made with a height of 20 cm to avoid stagnant water that could inhibit root growth. After that, treatment boards were installed in each plot to facilitate identification of the treatments applied. Groundnut seeds used consisted of local seeds obtained

from local farmers and seeds of the takar 2 variety obtained from Indonesian Legume and Tuber Crops Research Institute (ILETRI), Malang. Seeds were planted using a monoculture pattern, with a spacing of 30 cm between plants in regular rows. Planting was done using the tugal method, where each planting hole was filled with two groundnut seeds.

Formulation and Application of Vegetable Insecticides. In this study, two types of insecticides were used, namely chemical insecticides and vegetable insecticides, which were applied in accordance with the treatment on each combination of peanut varieties. The chemical insecticide used was deltamethrin 25 EC, at a dose of 2 ml per liter of water. The insecticide solution was applied using a manual sprayer with a spray volume of about 500 ml per plot, adjusted to plant growth conditions and environmental humidity. Spraying was done routinely every 7 days, starting when the plants were 14 days old until they reached 56 days after planting (HST). Meanwhile, the vegetable insecticide was made from 100 grams of bogenvil (*Bougainvillea* sp.) leaves that had been dried naturally in the shade for 15 days to maintain the content of its bioactive compounds. After the drying process, the leaves were boiled in 100 ml of water (1:1 ratio) at 90°C for 30 minutes, then filtered using gauze to separate the solution from the leaf pulp (Damayanti & Panjaitan, 2014). The extract obtained was then applied to all parts of the plant, especially on the leaf surface that was susceptible to pest attack, using a manual sprayer at a dose of 10 ml of extract per plant. Spraying was carried out once every 14 days during the plant growth phase.

Plant Maintenance. Plant maintenance is carried out through several stages, namely weeding, watering, and fertilizing. Weeding is done manually every two weeks to reduce competition between the main crop and weeds in obtaining nutrients. Watering was done twice a day, in the morning and evening, during the early growth phase, then reduced to once a day after the plants reached a stable vegetative phase. Fertilization was done twice, at planting time and at 30 days after planting (HST) to support optimal plant growth and pod formation.

Observation Parameters

Observations in this study were conducted four times at two-week intervals. The parameters observed included plant growth, yield, and pest presence. Observations of plant growth included measurement of plant height, measured from the base of the stem to the highest growing point, as well as calculation of the number of leaves on each individual plant in the plot.

Yield parameters included plant wet weight, which was obtained by weighing all parts of the plant after harvest, and the number of pods per plant to determine productivity. In addition, dry pod weight, which is weighed after the drying process until the moisture content stabilizes, and pod weight, which indicates the weight of pods containing good quality seeds, were measured. As part of the productivity analysis, the weight of empty pods, i.e., pods that do not contain seeds, was also calculated. The presence of insect pests was observed directly and using the sweep net method, where insect pests attacking the crop were identified and the number of individuals counted in each experimental plot.

Data Analysis

Data obtained from all parameters were tabulated and analyzed using the analysis of variance (ANOVA) method with the help of Statistical Analysis System (SAS) software version 9.4. If there were significant differences between treatments, then Tukey's further test ($P=0.05$) was conducted to determine which treatment gave the best results.

RESULTS AND DISCUSSION

Growth of Groundnut Plants

The results showed that the combination of improved seeds with insecticides, both chemical and plant-based, gave different effects on groundnut growth based on plant height and number of leaves (Figure 1). The treatment of 2 doses of seed with chemical insecticide made from deltamethrin (B1) produced the highest growth, with a plant height of about 45 cm and more than 20 leaves. This treatment shows that the combination of improved seeds and chemical insecticides that are effective in suppressing pests can optimize plant growth.

Treatment of takar 2 seeds with a vegetable insecticide based on bogenvil leaf extract (B2) also showed quite high growth, although slightly lower than B1, with a plant height of about 40 cm. In contrast, local seeds treated with chemical insecticides (A1) showed lower growth, around 25 cm, while the combination with plant-based insecticides (A2) gave better results, with plant height reaching 30 cm. This shows that plant-based insecticides can provide protection against pests, although their effectiveness is still lower than chemical insecticides.

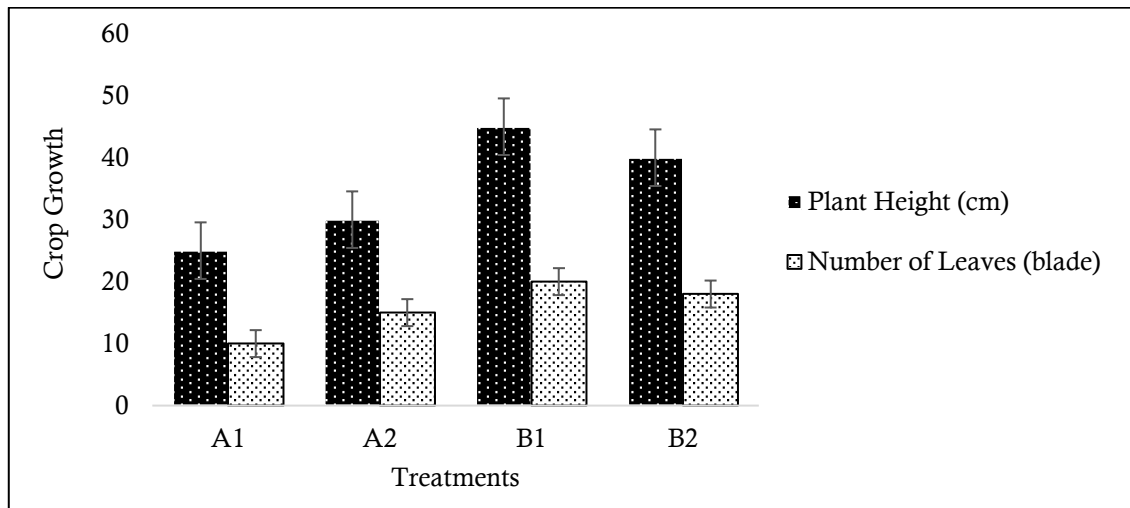


Figure 1. Growth chart of groundnut plants based on treatment

These results are in line with previous research showing that the use of improved seeds contributes to increased plant growth when combined with insecticides that are effective in pest control. Although plant-based insecticides have lower effectiveness than chemical insecticides, their use can be a more environmentally friendly alternative in a sustainable agricultural system (Sutriadi *et al.*, 2020).

Plant Wet Weight and Pod Number of Groundnut

The results showed that the combination of superior varieties with chemical and vegetable insecticides had a significant effect on the growth and yield of peanut plants (Table 1). Treatment B1, which is a combination of seed rate 2 with chemical insecticide made from deltamethrin, produced the highest plant wet weight of 287.42 g and the number of pods per plant of 286.93. These results are in line with research by Triyono *et al.* (2021), which states that the use of superior varieties can significantly increase groundnut yields.

Table 1. Effect of treatments on plant wet weight and number of pods per plant

Treatments	Mean (g)	
	Plant Wet Weight	Number of Pods per Plant
A1	108,02a	108,86a
A2	129,52a	129,03a
B1	287,42b	286,93b
B2	261,98b	261,49b

Description: A1 = combination of local seeds with chemical insecticide based on deltamethrin; A2 = combination of local seeds with plant-based insecticide based on bogenvil leaf extract; B1 = combination of seed rate 2 with chemical insecticide based on deltamethrin; and B2 = combination of seed rate 2 with plant-based insecticide based on bogenvil leaf extract.

Note: ^{a,b}, Different superscripts in the same column indicate differences ($P < 0.05$).

Treatment B2, a combination of seed rate 2 with a vegetable insecticide based on bougainvillea leaf extract, also showed good results with a plant wet weight of 261.98 g and the number of pods per plant of 261.49g. The effectiveness of this vegetable insecticide is supported by the research of Cahyati *et al.* (2023) who found that bougainvillea leaf extract has potential as a natural insecticide in controlling plant pests. This suggests that plant-based insecticides can be an effective and environmentally friendly alternative in pest control. In contrast, the A1 and A2 treatments, which used local seeds with both chemical and plant-based insecticides, showed lower results. The A1 treatment produced a plant wet weight of 108.02 g and number of pods per plant of 108.86 g, while A2 produced a plant wet weight of 129.52 g and number of pods per plant of 129.03 g. These results indicate that the use of high-yielding varieties is an effective and environmentally friendly alternative to chemical insecticides. These results indicate that the use of improved varieties has an important role in increasing the growth and yield of groundnut plants. In addition, the use of appropriate insecticides, both chemical and vegetable, can support the increase in yield. These findings are consistent with Kusyanto's (2020) research which showed that the use of improved varieties and good cultivation techniques can more than double groundnut productivity.

Groundnut Pod Weight

The results showed that treatment B1 gave the best results in all pod weight parameters, both wet and dry, and after the separation process between pods and empty pods (Table 2). This is in line with previous studies that showed the effectiveness of chemical insecticides in increasing groundnut yield.

Table 2. Mean Weight of Peanut Pods in Different Combination Treatments of Seeds and Insecticides

Treatments	Average Weight of Peanut Pods (g)			
	Wet Pods	Dry Pods	Whole Pods	Empty Pods
A1	0,78a	0,08a	0,29a	0,18a
A2	1,73a	0,29a	0,9a	0,43a
B1	5,09a	2,42a	2,18a	1,5a
B2	2,6a	1,24a	1,49a	1,01a

Description: A1 = combination of local seeds with chemical insecticide based on deltamethrin; A2 = combination of local seeds with plant-based insecticide based on bogenvil leaf extract; B1 = combination of seed rate 2 with chemical insecticide based on deltamethrin; and B2 = combination of seed rate 2 with plant-based insecticide based on bogenvil leaf extract.

Note: ^{a,b}, Different superscripts in the same column indicate differences ($P < 0.05$).

Research by Nurhidaya *et al.* (2013) revealed that deltamethrin application was effective in suppressing pod borer populations, thereby reducing pod damage and increasing peanut yields. Although the study did not specifically report pod weights, the reduction in pod damage due to pests may contribute to an increase in overall pod weight. In addition, the use of plant-based insecticides from bougainvillea leaf extract (A2 and B2) showed lower results compared to the use of chemical insecticides. Research by Prasetyo *et al.* (2021) showed that the application of vegetable insecticides from papaya leaves was able to suppress the intensity of leafroll caterpillar attacks on peanut plants, but its effectiveness depended on the concentration used. This difference in effectiveness indicates that the type of vegetable insecticide and its concentration need to be adjusted to achieve maximum results.

Seed type also plays an important role in determining crop yield. The Takar 2 seeds used in the B1 and B2 treatments showed better results than the local seeds in the A1 and A2 treatments. This shows that superior seeds have higher yield potential. Although specific research on the effect of seed type on groundnut pod weight is limited, in general, improved seeds have better genetic potential to produce high yields. Overall, the results of this study emphasize the importance of

selecting the right combination of seed type and insecticide type to achieve optimal yields in groundnut crops (Inayati & Marwoto, 2018; Antoro & Setiono, 2022). The use of improved seeds such as Takar 2 in combination with chemical insecticides made from deltamethrin proved to give the best results in this study. However, it should be noted that the use of chemical insecticides must be done wisely to avoid negative impacts on the environment and human health.

Insect Pests of Groundnut Crops

Based on this study, the effectiveness of various treatments against insect pests on groundnut plants can be seen from the total number of pests found. Treatment A1 (a combination of local seeds with chemical insecticide made from deltamethrin) showed the highest total number of pests, 21. This shows that although chemical insecticides were used, the pest population was still quite high, possibly due to pest resistance factors or less than optimal insecticide application. In contrast, treatment B2 (a combination of a 2-dose seed with a botanical insecticide based on bogenvil leaf extract) had the lowest total number of pests at 9, indicating relatively better effectiveness in suppressing pest populations (Table 3).

Table 3. Number of Insect Pests on Groundnut Plants Based on Treatment

Treatments	Insect Pests in Peanut Crops					Total (Tails)
	<i>Nezara viridula</i>	<i>Aproaerema modicella</i>	<i>Empoasca fasialin</i>	<i>Aphis craccivora</i>	<i>Spodoptera litura</i> F.	
A1	4	5	2	4	6	21
A2	2	7	2	1	3	15
B1	3	2	1	4	2	12
B2	2	1	3	2	1	9

Description: A1 = combination of local seeds with chemical insecticide based on deltamethrin; A2 = combination of local seeds with plant-based insecticide based on bogenvil leaf extract; B1 = combination of seed rate 2 with chemical insecticide based on deltamethrin; and B2 = combination of seed rate 2 with plant-based insecticide based on bogenvil leaf extract.

Treatment A2 (combination of local seeds with plant-based insecticides) had a total of 15 pests, which was lower than A1 but still higher than B2. This suggests that plant-based insecticides have potential in controlling pests, but their effectiveness may depend on factors such as extract concentration, frequency of application, and the resistance of the plant itself. Meanwhile, treatment B1 (combination of 2-dose seed with chemical insecticides) showed a total of 12 pests, which was lower than A1, but still higher than B2. This indicates that the use of 2-dose seed may have an influence on plant resistance to pests, although it still needs to be supported by an effective pest control strategy. Overall, these results indicate that the combination of seed rate 2 with vegetable insecticides (B2) is the most effective treatment in suppressing pest populations in groundnut plants. This could be an indication that takar 2 seeds have better resistance to pest attack, and the use of vegetable insecticides from bogenvil leaf extract provides effective protection, and is more supportive of food safety aspects.

CONCLUSION

Based on the results of the study, it was shown that the high-yielding variety of groundnut Takar 2 combined with chemical insecticide made from deltamethrin (treatment B1) produced the highest growth and production, characterized by greater plant height, number of leaves, wet weight, and number of pods per plant compared to other treatments. The combination of Takar 2 with botanical insecticide from bougainvillea leaves (B2) also gave good results, although slightly lower than B1. These results emphasize that the selection of superior varieties and the use of appropriate insecticides are very influential in increasing groundnut productivity. Chemical insecticides have proven effective, but their use needs to consider the impact of residues on health, natural enemies, and the environment. In contrast, plant-based insecticides, although slower to

take effect, are an environmentally friendly alternative and support sustainable farming systems. As a practical application, farmers are advised to prioritize the use of improved varieties in groundnut cultivation to increase productivity and pest resistance. In addition, the use of plant-based insecticides needs to be further developed, especially in terms of formulation and concentration, so that their effectiveness approaches that of chemical insecticides.

ACKNOWLEDGEMENTS

The authors would like to thank local government staff and farmers in Sambueja Village, Simbang Sub-district, Maros District, for their assistance in this research.

REFERENCES

- Antoro, A., & Setiono. (2022). Pengaruh Lama Penyimpanan Terhadap Viabilitas Benih Kacang Tanah (*Arachis hypogaea* L) Varietas Takar 2. *Jurnal Sains Agro*, 7(1), 46-53. <https://doi.org/10.36355/jsa.v7i1>
- Cahyati I., Damayanti T. A., & Santoso S. (2023). Kombinasi Tanaman Penghalang, Kitosan, dan Ekstrak Daun Bugenvil untuk Pengelolaan Virus pada Tanaman Kedelai. *Jurnal Fitopatologi Indonesia*, 19(4), 166-175. <https://doi.org/10.14692/jfi.19.4.166-175>
- Damayanti, T. A., & Panjaitan, M. T. (2014). Aktivitas antivirus beberapa ekstrak tanaman terhadap *Bean common mosaic virus* strain Blackeye Cowpea (BCMV-BIC) pada kacang panjang. *Journal of Tropical Plant Pests and Diseases*, 14(1), 32-40. <https://doi.org/10.23960/j.hptt.11432-40>
- Fitriadi, B.R., & Putri, A.C. 2016. Metode-Metode Pengurangan Residu Pestisida pada Hasil Pertanian/ Methods of Pesticide Residue Reduction on Agriculture Products. *Jurnal Rekayasa Kimia dan Lingkungan*, 11(2), 61-71. <https://doi.org/10.23955/rkl.v11i2.4950>
- Inayati, A., & Marwoto, M. (2018). Pengaruh Kombinasi Aplikasi Insektisida Dan Varietas Unggul Terhadap Intensitas Serangan Kutu Kebul Dan Hasil Kedelai. *Jurnal Penelitian Pertanian Tanaman Pangan*, 31(1),13-21.
- Indiati, S.W. 2014. Pengendalian Hama Thrips Kacang Hijau Dengan Insektisida Nabati dan Kimia. *Buletin Palawija*, 27, 39-51.
- Kasim, N. N., Prihatin, P., Sukmawati, S., & Wiridannisaa, N. (2024). Estimation of Yield Loss Due to Striped Disease in Peanut Plants in Palopo City, South Sulawesi. *Jurnal Biologi Tropis*, 24(2), 139-145. <https://doi.org/10.29303/jbt.v24i2.6641>
- Kasno & Harnowo. 2014. Karakteristik Varietas Unggul Kacang Tanah dan Adopsinya oleh Petani. *Buletin Iptek Tanaman Pangan*, 9(1),13-23.
- Kurniawan R. M., Purnamawati H., & E. KY. W. (2017). Respon Pertumbuhan dan Produksi Kacang Tanah (*Arachis hypogaea* L.) terhadap Sistem Tanam Alur dan Pemberian Jenis Pupuk. *Buletin Agrohorti*, 5(3), 342-350. <https://doi.org/10.29244/agrob.v5i3.16472>
- Mahmud, K., Makaju, S., Ibrahim, R., & Missaoui, A.(2020). Current progress in nitrogen fixingplants and microbiome research. *Plants*, 9(1), 1-17. <https://doi.org/10.3390/plants9010097>
- Nurhidaya, Apriyanto, D., & Sunardi. (2013). Pengendalian Penggerek Polong Kedelai (*Etiella zinckenella Treitschake*.) pada Tanaman Kacang Tanah dengan Tanaman Perangkap, Aplikasi Insektisida Nabati dan Nematoda Patogen Serangga. Tesis: Fakultas Pertanian, Universitas Bengkulu.
- Paturohman, E., & Sumarno. (2014). Peningkatan Produktivitas Kacang Tanah Melalui Penerapan Komponen Teknologi Kunci. *Iptek Tanaman Pangan*, 9(2), 97-107.
- Prasetyo, A. D., Santoso, S. J., & Siswadi. (2021). Kajian Pestisida Nabati Terhadap Hama Ulat Penggulung (*Lamprosema indicata*) pada Tanaman Kacang Tanah (*Arachis hipogaeae* L.). *Innofarm: Jurnal Inovasi Pertanian*, 23 (2): 193-201. <https://doi.org/10.33061/innofarm.v23i2.6263>
- Sapalina, F., Novianti Ginting, E., & Hidayat, F. (2022). Bakteri Penambat Nitrogen sebagai Agen Biofertilizer. *WARTA Pusat Penelitian Kelapa Sawit*, 27(1), 41-50. <https://doi.org/10.22302/iopri.war.warta.v27i1.80>

- Sinambela, B. R. 2024. Dampak penggunaan Pestisida dalam Kegiatan Pertanian terhadap Lingkungan Hidup dan Kesehatan. *Jurnal Agrotek: Jurnal Ilmiah Ilmu Pertanian*, 8(2), 178-187. <http://dx.doi.org/10.33096/agrotek.v8i1.478>
- Suryani, D., Pratamasari, R., Suyitno, S., & Maretalinia, M. (2020). Perilaku Petani Padi dalam Penggunaan Pestisida di Desa Mandalahurip Kecamatan Jatiwaras Kabupaten Tasikmalaya . *Window of Health : Jurnal Kesehatan*, 3(2), 095-103. <https://doi.org/10.33096/woh.v3i2.602>
- Sutriadi, M. T., Harsanti, E. S., Wahyuni, S., & Wihardjaka, A. (2020). Pestisida Nabati: Prospek Pengendali Hama Ramah Lingkungan. *Jurnal Sumberdaya Lahan*, 13(2), 89. <http://dx.doi.org/10.21082/jsdl.v13n2.2019.89-101>
- Triyono, K., Priyono, P., & Agustina, W. (2021). Pertumbuhan dan Hasil Tiga Varietas Kacang Tanah pada Jarak Tanam dan Macam Pengendalian Gulma. *Journal Galung Tropika*, 10(3), 313–322. <https://doi.org/10.31850/jgt.v10i3.794>
- Wahyudi, A.A., Maimunah & Pane, E. (2019). Respon Pertumbuhan Dan Produksi Kacang Tanah (*Arachis Hypogaea* L.) Terhadap Pemberian Pupuk Kandang Kambing dan Pupuk Organik Cair Bonggol Pisang. *Jurnal Ilmiah Pertanian (JIPERTA)*, 1(1),1-8. <http://dx.doi.org/10.31289/jiperta.v1i1.79>
- Zulfi, F., Damayanti, T., & Giyanto, G. (2024). Management effort of mottle virus by leaf extract of moringa (*Moringa oleifera* Lam.) and bougainvillea (*Bougainvillea spectabilis* Willd.) on peanut. *Agrovigor: Jurnal Agroekoteknologi*, 17(1), 48-54. <https://doi.org/10.21107/agrovigor.v17i1.25086>