Formosa Journal of Science and Technology (FJST)
Vol. 5, No. 1, 2026: 231-242

Effectiveness of Botanical Insecticides from Virginia Tobacco Bark in Controlling Whiteflies and Increasing Potato Plant Productivity

Srilah Nora Wahyuni[1], M. Taufik Fauzi[2], M. Sarjan[3]
Master of Dryland Agriculture Study Program, Postgraduate, University of Mataram
Corresponding Author: Srilah Nora Wahyuni, snorawahyuni@gmail.com

ARTICLEINFO
Keywords: Vegetable Insecticide, Tobacco Stem Bark, Whiteflies, Productivity, Potato Crops.

Received : 27, November
Revised : 29, December
Accepted: 30, January

ABSTRACT
This study evaluated the effectiveness of a botanical insecticide derived from Virginia tobacco (*Nicotiana tabacum* L.) bark in controlling whitefly (*Bemisia tabaci*) populations and infestation intensity, as well as its impact on potato (*Solanum tuberosum* L.) productivity. A completely randomized design was applied using six insecticide concentrations (0%, 2%, 4%, 6%, 8%, and 10%) on Tedjo MZ potato plants. The results showed a significant negative linear relationship between insecticide concentration and pest population (R^2 = 0.98) as well as infestation intensity (R^2 = 0.99). The highest pest population (3.92 individuals per plant) and infestation intensity (12.31%) occurred in the control treatment, while the lowest values (3.03 individuals per plant and 11.21%) were observed at the 10% concentration, achieving a population suppression effectiveness of 22.82%. A strong correlation between pest population and infestation intensity (R^2 = 0.98) indicated that each additional pest increased infestation intensity by 1.27%. Botanical insecticide application significantly improved yield, increasing tuber number by 66.67% and tuber weight by 82.93% at the 10% concentration, with very strong correlations (R^2 > 0.99). The insecticidal activity is attributed to nicotine alkaloids acting as neurotoxins and secondary phytochemicals with multiple toxic effects. These findings demonstrate the strong potential of tobacco-based botanical insecticides as a sustainable, environmentally friendly, and economically beneficial component of integrated pest management

ISSN-E: 2964-6804
DOI: https://doi.org/10.55927/fjst.v5i1.346
https://traformosapublisher.org/index.php/fjst

INTRODUCTION

Whitefly (*Bemisia tabaci*) is one of the main pests that attack potato plants (*Solanum tuberosum* L.) in Indonesia, including in the West Nusa Tenggara region. This pest belongs to the order Hemiptera, family Aleyrodidae, and is known to be the main vector of the spread of geminiviruses and potyviruses that can cause yield losses of up to 50-70% (Husni *et al*., 2024). The biological characteristics of whiteflies that have a short life cycle (14-28 days), a high reproductive rate (100-300 eggs per female), and adaptability to various environmental conditions make their control a serious challenge for potato farmers.

The intensive use of synthetic pesticides has become the main choice of farmers in controlling whiteflies. However, the overuse of chemical pesticides causes a variety of environmental and health problems, including pest resistance, mortality of beneficial arthropods, soil and water contamination, and residues on harvested products (Listiyati *et al*., 2022). Studies and surveys in the Sembalun potato center area, East Lombok District, show that farmers still rely on the intensive application of chemical pesticides in higher doses to control plant pests, because it is considered the fastest and most effective in overcoming pest disturbances but has a negative impact on the sustainability of the environmental ecosystem and risks pest resistance, as well as residues in potato yields (Paolina *et al*., 2025).

In the context of agricultural sustainability and Indonesia's commitment to the Sustainable Development Goals (SDGs), especially SDG 12 (Responsible Consumption and Production) and SDG 15 (Life on Land), the development of plant-based insecticides is a promising alternative. Vegetable insecticides from tobacco plants (*Nicotiana tabacum* L.), especially from stem bark, contain nicotine alkaloid compounds that have been proven to have high insecticidal activity (Silalahi, 2021).

Virginia tobacco bark is an abundant agricultural waste in tobacco-producing areas such as East Java and NTB. The use of this waste as a raw material for plant-based insecticides not only reduces environmental pollution but also creates economic added value for tobacco farmers. Previous research by Thei (2023) reported the effectiveness of tobacco extract against *B. tabaci*, but has not provided measurable quantitative data on dose-response relationships and direct impacts on potato productivity.

The gap in the existing research is the lack of comprehensive information on: (1) the mathematical relationship between the concentration of plant insecticides and population dynamics and the intensity of pest attacks; (2) quantitative correlation between pest control and increased production yield; and (3) synergistic mechanisms of active compounds in plant insecticides on the physiological system of potato plants. Therefore, this study was designed to fill this knowledge gap by presenting measurable empirical data and in-depth mechanistic analysis and to evaluate the effectiveness of plant-based insecticides from Virginia tobacco stem bark (*Nicotiana tabacum* L.) in controlling the population and intensity of whitefly (*Bemisia tabaci*) infestation as well as its impact on potato crop productivity (*Solanum tuberosum* L.).

THEORITICAL REVIEW

The Problem of Whitefly Attacks on Potato Plants

Whitefly (*Bemisia tabaci*) is the main pest in potato plants (*Solanum tuberosum* L.) which has a significant impact on decreased productivity. This pest attack causes direct damage through the fluid suction activity of phloem, resulting in leaf chlorosis, decreased rate of photosynthesis, and disruption of assimilate distribution to the bulbs. In addition, *B. tabaci* also acts as a vector for various plant viruses that can exacerbate yield losses (Husni *et al*., 2024). The biological characteristics of whiteflies, such as a relatively short life cycle, high reproduction rate, and extensive adaptability to various environmental conditions, make this pest difficult to control. The increase in whitefly populations is directly correlated with increasing attack intensity and crop damage rates, so population control is a key factor in maintaining potato yields (Al-Mutmainah, 2022).

The Impact of the Use of Synthetic Pesticides in Whitefly Control

Whitefly control at the farmer level generally still relies on synthetic pesticides because they are considered fast and effective. However, the intensive and repeated use of chemical pesticides has caused various problems, including pest resistance, death of non-target organisms, environmental pollution, and pesticide residues in agricultural products (Listiyati *et al*., 2022). In the long term, reliance on synthetic pesticides not only threatens the sustainability of agroecosystems, but also goes against the principles of sustainable agriculture and Integrated Pest Control (PHT). Therefore, an alternative pest control that is effective, environmentally friendly, and can be applied practically by farmers is needed.

Plant-Based Insecticides as a Sustainable Pest Control Alternative

Vegetable insecticides are pest control materials derived from secondary metabolite compounds of plants and have long been known to have insecticidal activity. These insecticides work through various mechanisms, such as contact poisons, stomach poisons, *antifeedants*, and inhibition of insect growth and development (Silalahi *et al*., 2021). Compared to synthetic pesticides, plant-based insecticides have the advantages of being easily degraded in the environment, relatively safe for non-target organisms, and reducing the risk of pest resistance. Therefore, plant-based insecticides are one of the important components in the implementation of PHT that supports the sustainability of agricultural systems.

The Potential of Virginia Tobacco Stem Bark as a Plant-Based Insecticide

The tobacco plant (*Nicotiana tabacum* L.) is known to contain nicotine alkaloid compounds that are neurotoxic to insects. Nicotine works by disrupting the central nervous system of insects through inhibiting the transmission of nerve impulses, thereby causing paralysis and death (Silalahi *et al*., 2021). In addition to nicotine, tobacco also contains other compounds such as flavonoids, saponins, and terpenoids that have toxic and synergistic effects on insect pests. Virginia tobacco bark is an abundant amount of agricultural waste in tobacco production center areas, including in the West Nusa Tenggara region. The use of this waste as a raw material for plant-based insecticides not only reduces environmental pollution, but also increases the added value of agricultural waste. Several studies have shown that tobacco extract is effective in suppressing populations of leaf-sucking pests, including whiteflies, but it is still limited to descriptive reports without a measurable dose-response relationship analysis (Thei, 2023).

The Relationship of Plant Insecticide Concentration with Pest Attack Population and Intensity

Theoretically, the effectiveness of plant-based insecticides is greatly influenced by the concentration of active ingredients used. Increasing the concentration of plant-based insecticides will increase the number of toxic compounds that come into contact with pests, resulting in greater pest mortality and decreased feeding activity. This relationship generally follows a dose–response pattern, where an increase in concentration is followed by a decrease in the population and intensity of pest attacks (Irawan *et al*., 2024). The decline in the whitefly population will have a direct impact on the decrease in the intensity of attacks, due to the reduction in the number of individuals who carry out plant fluid smoking activities. Thus, pest population control is a strategic approach to reduce the overall rate of crop damage.

The Effect of Whitefly Control on Potato Productivity

The productivity of potato plants is highly dependent on the physiological conditions of the plant during the growth and formation phases of tubers. High whitefly infestation can reduce the plant's ability to photosynthesize and inhibit the distribution of photosynthetic results to storage organs, thereby reducing the number and weight of bulbs (Ardiyani *et al*., 2025). Theoretically, effective pest control will reduce the physiological stress of the plant and allow for a more optimal allocation of energy for bulb formation. Therefore, the application of vegetable insecticides that are able to suppress the population and intensity of whitefly attacks is expected to significantly increase potato yields, both in terms of the number and weight of tubers.

Research Gap and Research Framework of Thought

Based on theoretical studies, there are still research gaps related to whitefly control using plant-based insecticides. Previous studies have generally not comprehensively examined the mathematical relationship between plant insecticide concentrations and population dynamics and pest attack intensity, nor have they analyzed the quantitative correlation between pest control levels and increased potato yields. In addition, the synergistic mechanisms of the active compounds in the plant insecticide of the Virginia tobacco stem bark on the physiological system of the potato plant are still limited in information. Therefore, this research is designed to fill the knowledge gap through the presentation of measurable empirical data and mechanistic analysis, so as to provide a stronger scientific basis for the use of plant-based insecticides as an alternative to sustainable integrated pest control.

METHODOLOGY

The method used in this study is an experimental method with experiments in the field. The field experiment was carried out from March to June 2025 in Sembalun Village, Sembalun District, East Lombok Regency, West Nusa Tenggara Province (NTB).

The tools used include hoes, hand sprayers, knives, scissors, bamboo, hand counters, boards, microscopes, mobile phone cameras, magnifying glasses, specimen bottles, measuring cups, thermohygrometers, yellow pan traps, yellow sticky traps, pitfall traps, filters, buckets, brushes, small spray bottles, petri dishes, tweezers, and stationery. Meanwhile, the materials used are Tedjo MZ variety potato seeds, water, vegetable insecticides based on Virginia tobacco stem bark (not commercial products), goat manure, commercial liquid organic fertilizer, aloe vera, detergent, 70% alcohol, glue, duct tape, tissues, label paper, gauze, transparent plastic, and raffia rope.

The study used a Group Random Design (RAK) with 6 treatments and 4 replicates so that there were 24 experimental units. The treatments tested were as follows: P0 = 0% control (Without pesticide treatment); P1 = 2% vegetable insecticide (20 ml/L water); P2 = Vegetable insecticide 4% (40 ml/L water); P3 = Vegetable insecticide 6% (60 ml/L water); P4 = 8% vegetable insecticide (80 ml/L water); P5 = 10% vegetable insecticide (100 ml/L water).

Manufacture of plant-based insecticide base solutions: The main ingredient used is tobacco stem bark obtained from farmers after the last harvest. The bark of the tobacco stem is peeled and then dried. A basic solution of vegetable insecticide is made by soaking 1 kg of tobacco bark in 2.5 liters of clean water. The mixture is stirred and squeezed for approximately 30 minutes, then left for 24 hours. Post-soaking, the solution is filtered to separate the filtrate (soaking water) from the residue of the bark, with the soaking water being the base solution.

Next, the basic solution is added with natural adhesives derived from aloe vera (300 grams of aloe vera meat + 600 ml of water and in a blender and filtered then put into a bottle with an adhesive concentration of 12%). This adhesive solution is then mixed into the base solution, stirred for 5 to 10 minutes, and filtered back into a clean container. A vegetable insecticide solution is ready for application.

Vegetable insecticide application is carried out using a knapsack sprayer with a flat fan nozzle at a pressure of 2 bar. Spray volume 500 liters per hectare. Application is carried out in the morning (06:00-08:00) to minimize photodegradation and maximize plant absorption. Application interval of 7 days from the age of the plant 28 days after planting (HST) to 70 HST (total 8 applications). Application to plants by targeting the entire underside of the leaf surface and calibrating it first.

The implementation of the research includes land preparation, planting, trap placement, fertilization, irrigation, stocking, weeding removal, and harvesting. Observation parameters included pest population, pest attack intensity, and potato tuber yield (number and weight of potato tubers. Measurement of tuber yield parameters is carried out after harvest.

Pest Population: Pest population data is obtained through a sampling method with two approaches, namely direct and indirect observation. Direct observation is carried out by counting the number of individual pests found on the sample plants in the field. Each experimental plot had 48 plants. The sample plants used were 5 plants and were randomly selected with a zig-zag pattern. Observations were made 8 times at intervals of one week, starting when the plant is four weeks old after planting (4 MST). Meanwhile, indirect observations were carried out using traps such as *yellow sticky* traps, *yellow pan traps, pitfall traps*, which were installed around the experimental area. The number of pests successfully captured through all methods used is then calculated or calculated based on the number of individuals per plant and recorded as pest population data for each treatment. All observation activities were carried out in the morning, between 07.00 to 09.00 WITA. The pests are collected and put in specimen bottles that have filled 70% alcohol

Whitefly pest attack intensity: Attack intensity is measured using a visual damage index (VDI) score

Attack Intensity Formula:

$$\text{IS} = \frac{\sum(\text{ni x vi})}{NxZ}\ x\ 100\%$$

Description: IS: Pest attack intensity (%); ni: The number of leaves of plants that are infested by pests; vi: Value of the damage scale; Z: The highest attack category scale; N: The number of plants or plant parts observed.

The value of the pest attack category (v) based on the intensity of the pest attack (Sapriandi *et al*., 2023): 0. No damage; 1. Damage > 0 - 25% = Light; 2. Damage > 25 – 50% = Medium; 3. Damage > 50 – 75% = Weight; 4. Damage > 75 – 100% = Very Heavy.

Yield (Number and Weight of Tubers) on potato crops: At harvest (84 HST), measured:

Number of bulbs per plant: calculated once after the crop is harvested. The calculation was carried out on each sample crop. The data obtained is the average number of bulbs per sample plant observed.

Tuber weight per plant: Potato tuber weight is calculated after harvest on the sample crop. Before weighing, the tubers are cleaned of any remaining soil that sticks, then weighed using an analytical scale to obtain accurate results.

To calculate the ability to suppress the pest population and the intensity of the attack, it is calculated using the following formula:

$$\text{Pressing ability (\%)} = \frac{P0-P}{P0}\ X\ 100\%$$

Description :

P0 = Mean value on the control treatment (without treatment)

P = Average value at treatment (plant-based insecticide concentration)

$$\text{Ability to increase yield (\%)} = \frac{P-P0}{P0} \; X \; 100\%$$

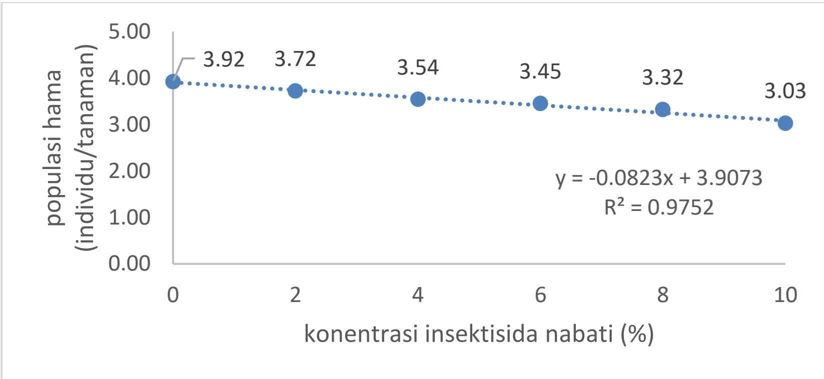
Description :
P0 = Average yield value at the control treatment (without treatment)
P = Average value of yield at treatment (concentration of vegetable insecticide)

Data Analysis: The observation data was analyzed using fingerprint analysis at a real level of 5%, and if there were differences , it was followed by orthogonal polynomial tests and regression analysis.

RESULTS AND DISCUSSION

Pest Population

The pest population due to the application of Virginia tobacco bark plant insecticides shows a linear regression relationship as seen in Graph 1.



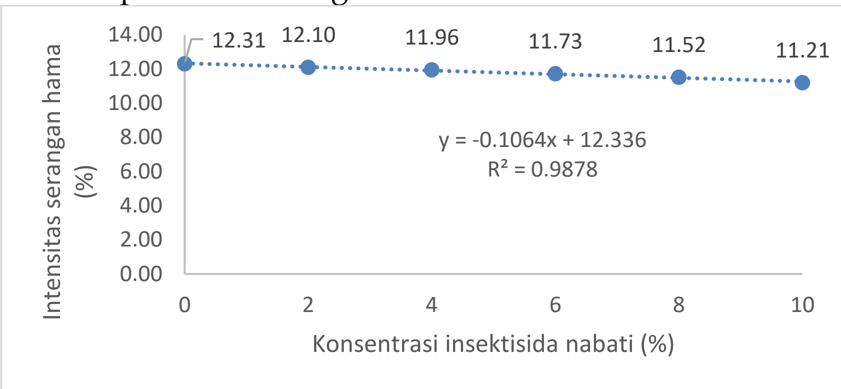
Graph 1. The relationship between the concentration of bark plant insecticides and pest populations in potato plants

The results of the analysis showed that the application of plant-based insecticides from the bark of Virginia tobacco stalks resulted in a significant decline in whitefly populations linearly as concentrations increased (Graph 1). The highest pest population occurred at the control treatment (P0) of 3.92 individuals per plant, while the lowest population occurred at a concentration of 10% (P5) of 3.03 individuals per plant. Analysis of orthogonal polynomial regression confirmed a very strong linear relationship between plant insecticide concentrations and a decrease in pest populations ($R^2 = 0.98$, $p < 0.001$). Increased concentrations of plant insecticides provide a progressive population suppression effect (Table 1).

The ability to suppress the pest population increased from 5.12% at a concentration of 2% to 22.82% at a concentration of 10%. This consistent pattern of decline indicates that plant-based insecticides have predictable and measurable effectiveness. The decline in pest populations due to the application of vegetable insecticides is caused by the content of active compounds such as nicotine alkaloids and nicotine sulfate which act as contact poisons that effectively kill pests so that they can effectively reduce pest populations. In addition, the success of whitefly control is further strengthened by the presence of other phytochemical compounds such as saponins, flavonoids, and terpenoids that are toxic to insects (Silalahi, 2021; Listiyati *et al*., 2022; Wahyuni *et al*., 2025).

Pest Attack Intensity

The relationship between the application of various concentrations of plant insecticides from the bark of Virginia tobacco stalks to the intensity of whitefly attacks is presented in Figure 2.



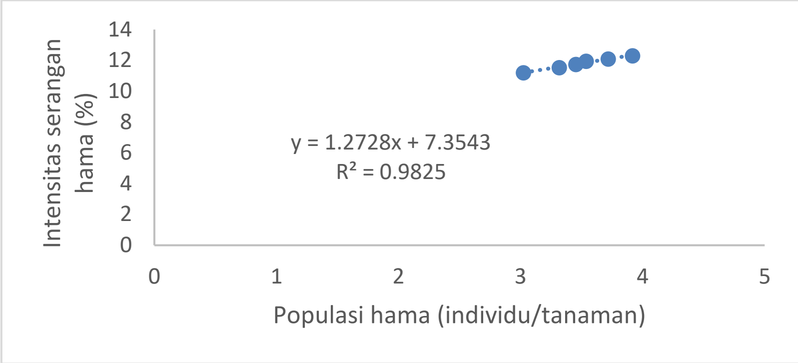
Graph 2. The relationship between the application of various concentrations of vegetable insecticides and the intensity of pest attacks on potato plants

The intensity of pest attacks shows a similar pattern to that of the pest population, i.e. a linear decrease as the concentration of plant insecticides increases (Graph 2). The highest attack intensity occurred at the control (12.30%) and lowest at the concentration of 10% (11.20%). Regression analysis showed a very strong linear relationship ($R^2 = 0.98$, $p < 0.001$). The concentration of plant insecticides has an effect on decreasing the intensity of pest attacks (Table 1.). The ability to suppress attack intensity increased from 1.68% at a concentration of 2% to 8.92% at a concentration of 10%. Although the absolute decrease in attack intensity is relatively small, this value is statistically and biologically significant, given that the intensity of the attack reflects cumulative damage to the crop.

The high incidence of whiteflies is triggered by large pest populations and the availability of abundant food sources, as plants achieve optimal growth with lush crown conditions, increased leaf count, high rate of photosynthesis, and enter the generative phase for bulb formation. This pest attack inhibits the photosynthesis process optimally, thus having an impact on crop yields, and the subsequent decrease in the number of leaves also decreases the population and intensity of whitefly attacks (Kudus, 2018; Irawan *et al*., 2024). A decrease in the intensity of pest attacks can be caused by increased pest mortality and environmental conditions that do not support their survival, thus affecting feeding behavior or encouraging migration to other areas that have more suitable conditions and feed sources, considering that whiteflies are polyphages with a variety of host plants (Husni *et al*., 2024; AlMutmainah, 2022).

The Relationship of Pest Populations to Attack Intensity

The application of tobacco bark plant insecticides at various concentrations showed a very close relationship between pest populations and whitefly attack intensity as seen in Graph 3.

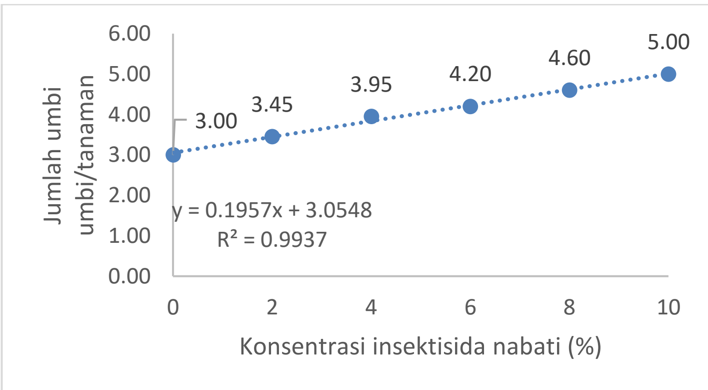


Graph 3. The relationship between the application of various concentrations of plant insecticides to pest populations and the intensity of pest attacks on potato plants

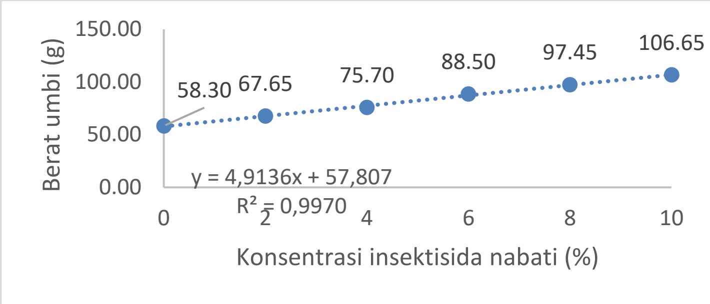
Correlation analysis showed a very close relationship between pest populations and attack intensity (Graph 3.). A determination coefficient (R^2) of 0.9825 indicates that 98.25% variation in attack intensity is explained by pest population dynamics. The regression equation showed that each increase of one pest individual per plant increased the intensity of the attack by 1.27% ($p < 0.001$). These results are consistent with the research of Husni *et al*. (2024) which reported a significant positive correlation between whitefly populations and attack intensity on potato plants with a correlation coefficient of 0.94. These findings confirm that pest populations are a major driving factor in crop damage rates.

The Relationship of Plant-Based Insecticide Concentration From Tobacco Stem Bark to Plant Hail (Number And Weight Of Bulbs)

The results of the study show that there is a positive relationship between the concentration of vegetable insecticides of virginia tobacco stalks and crop yields can be seen in the graph of the number of potato tubers (Graph 4.) and the weight of the potato tubers produced can be seen in the graph of the number of potato tubers (Graph 5.)



Graph 4. The relationship between the application of various concentrations of vegetable insecticides and the number of potato tubers in potato plants



Graph 5. The relationship between the application of various concentrations of vegetable insecticides and the weight of tubers in potato plants

Based on the graph it shows that the application of vegetable insecticides consistently increases the number and weight of potato tubers. At 0% concentration, the lowest tubers were produced, where the lowest number of tubers was recorded at 3.00 tubers per plant, while the lowest tuber weight was 58.30 grams per plant. The highest yield was produced by applying the highest concentration of 10% where the highest number of tubers was 5.00 tubers per plant and the highest tuber weight was 106.65 grams per plant). Increasing potato yield with increasing the concentration of vegetable insecticides has a very close relationship where the number of tubers is 99.37% and the weight of tubers is 99.70% is able to increase yields. This means that the higher the concentration of vegetable insecticides given, the number of tubers and the weight of potato tubers increases. This shows that the application of plant-based insecticides is able to reduce the population and intensity of pest attacks.

This phenomenon suggests that the application of plant-based insecticides is effective in lowering the population and intensity of pest attacks, including whiteflies. Whitefly itself can significantly reduce the number of bulbs and the weight of the bulbs by several mechanisms, such as sucking phloem fluid from the leaves resulting in the loss of nutrients essential for bulb formation, and the excretion of honey which supports the growth of soot dew that covers the leaves thereby inhibiting photosynthesis and reducing plant productivity (Ardiyani *et al.*, 2025). Plant-based insecticides from tobacco stalks have been shown to be effective in suppressing populations of leaf-sucking pests such as *B. tabaci* and reducing the intensity of attacks, resulting in significant increase in plant growth and yield (Thei, 2023).

The Ability to Suppress the Population and Intensity of Attacks, and Increase Results

The use of tobacco bark insecticides with various concentrations is able to reduce the population and intensity of whitefly attacks, and is able to increase potato yields as seen in Table 4.1.

Table 4.1. Ability to Suppress Pest Population and Pest Attack Intensity, as well as Ability to Increase Yield (Number of Bulbs and Bulb Weight)

Treatment	Pressing Ability		Ability to Improve Results	
	Population	Intensity	Number of bulbs	Tuber weight
P1	5,12%	1,68%	15,00%	16,04%

P2	9,69%	2,86%	31,67%	29,85%
P3	11,88%	4,68%	40,00%	51,80%
P4	15,35%	6,38%	53,33%	67,16%
P5	22,82%	8,92%	66,67%	82,93%

Description: P1= Vegetable insecticide concentration 2%, P2= Vegetable insecticide concentration 4%, P3= Vegetable insecticide concentration 6%, P4 = Vegetable insecticide concentration 8%, P5 = Vegetable insecticide concentration 10%

Data in Table 4.1. It shows that an increase in the concentration of vegetable insecticides not only has a linearly effect on population decline and pest attack intensity, but also in parallel increases yields (number and weight of bulbs). At the lowest concentration (2%; P1), the ability to suppress the new pest population reached 5.12% with an emphasis on attack intensity of 1.68%, accompanied by an increase in the number of bulbs by 15.00% and the weight of bulbs by 16.04%. Along with the increase in concentration to 10% (P5), the ability to suppress the pest population increased sharply to 22.82%, the decrease in attack intensity reached 8.92%, while the increase in the number and weight of tubers reached 66.67% and 82.93%, respectively. This pattern shows a very consistent dose–response relationship, where stronger pest control is directly converted into higher yield increases.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research and the description of the discussion with a limited scope of research, it can be concluded that this finding shows the great potential of plant-based insecticides as an integrated pest control alternative that is sustainable, environmentally friendly, and beneficial to the farmer's economy. The application of vegetable insecticides from the bark of Virginia tobacco stalks is able to suppress the pest population and the intensity of whitefly pest attacks, and the application of various concentrations of vegetable insecticides is able to increase the yield (number and weight of bulbs) of potatoes.

FURTHER STUDY

Based on the effectiveness of the plant-based insecticide of Virginia tobacco stem bark in decreasing the population and intensity of whitefly attacks and increasing the number and weight of potato tubers, further research is recommended to test its effectiveness by considering the economic threshold, analyze the economic threshold of whiteflies, and compare the effectiveness on other potato varieties and different agroecology in NTB.

ACKNOWLEDGMENT

The author expresses sincere gratitude to the research team led by Prof. Muhammad Sarjan, M.Agr.CP., Ph.D., under the 2025 PNBP Grand Professor Research Scheme at University of Mataram (UNRAM).

REFERENCES

Al-Mutmainah, A. (2022). Populasi dan Intensitas Serangan Hama Kutu Kebul pada Tanaman Kentang yang Ditumpangsarikan dengan Tanaman Refugia. *Jurnal Agroteksos*, 33(1), 112–121. https://eprints.unram.ac.id/id/eprint/39725

Ardiyani, P. M., Sarjan, M., & Petrunella, R. S. (2025). Pengaruh Keberadaan Hama Kutu Kebul (Homoptera: Aleyrodidae) terhadap Tingkat Hasil Beberapa Varietas Kentang (*Solanum tuberosum* L.) di Sembalun Lombok Timur. *Jurnal Ilmiah Mahasiswa Agrokomplek*, *4*(1), 273-283. https://doi.org/10.29303/jima.v4i1.7157

Husni, I. R., Thei, R. S. P., & Fauzi, M. T. (2024). Populasi dan Intensitas Serangan Hama Kutu Kebul (*Bemisia* Spp.) pada Tanaman Kentang yang Ditumpangsarikan dengan Beberapa Tanaman Aromatik. *AGROTEKSOS*, *34*(2), 775-784. https://doi.org/10.29303/agroteksos.v34i2.1076

Irawan, R., Sarjan, M., & Muthahanas, I. (2024). Penggunaan Beberapa Konsentrasi Ekstrak Daun Paitan (*Tithonia diversifolia*) untuk Mengendalikan Hama Kutu Kebul (*Bemisia tabaci* Genn.) pada Tanaman Kentang (*Solanum tuberosum* L.). *Jurnal Ilmiah Mahasiswa Agrokomplek*, *3*(2), 74-85. https://doi.org/10.29303/jima.v3i2.5163

Kudus F. (2018). Potensi Kumbang *Epilachna* sp. sebagai Hama pada Tanaman Kentang (*Solanum tuberosum* L.) di Dataran Medium Aik Berik. Fakultas Pertanian. Universitas Mataram.

Listiyati, A. K., Nurkalis, U., & Hestiningsih, R. (2022). Ekstraksi Nikotin dari Daun Tembakau (*Nicotina tabacum*) dan Pemanfaatannya sebagai Insektisida Nabati Pembunuh *Aedes* Sp. *Jurnal Ilmiah Mahasiswa*, *2*(2). https://ejournal.undip.ac.id/index.php/jim/article/view/10748/8525

Paolina, S., Sarjan, M., & Haryanto, H. (2025). Pengaruh Konsentrasi Pestisida Nabati Daun Paitan (*Tithonia diversifolia*) terhadap Populasi dan Intensitas Serangan Hama Kumbang (*Epilachna* sp.) pada Tanaman Kentang (Solanum tuberosum L.) di Sembalun. *Jurnal Ilmiah Mahasiswa Agrokomplek*, *4*(2), 420-430. https://doi.org/10.29303/jima.v4i2.7159

Silalahi, A.S. H., Supriyatdi, D., & Sudirman, A. (2021). Respons Ulat Grayak (*Spodoptera litura*) terhadap Lama Perendaman Tembakau Rajang (*Nicotiana tabacum* L.) sebagai Insektisida Nabati. *Agrosains: Jurnal Penelitian Agronomi*, 23(2), 84-88.

Thei, R. S. P. (2023). Effectiveness of Botanical Pesticides from Wastes of Virginia Tobacco Stems in Reducing Populations of leaf-sucking Pest and Occurrence of Virus Disease Symptoms on Potato Plants. *Int J Hortic Agric Food Sci*, *7*, 22-30. https://dx.doi.org/10.22161/ijhaf.7.2

Wahyuni, S. N., Sudarmawan, A. A., & Sudantha, I. M. (2025). Potensi of Tobacco Stem Insecticide as Pest Control in Crops. *Jurnal Biologi Tropis*, *25*(1), 689-698. https://doi.org/10.29303/jbt.v25i1.8053