

## Dual utilisation of *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae) as bokashi fertiliser and botanical pesticide to enhance growth and yield of chilli (*Capsicum annuum* L.; Solanaceae)

Dhiva Kinanti Diadara<sup>1\*</sup>, Weri Herlin<sup>2</sup>, Astuti Kurnianingsih<sup>3</sup>

<sup>1</sup>Plant Science Department, Faculty of Agriculture, Universitas Sriwijaya, Indralaya 30622, Ogan Ilir, South Sumatra, Indonesia.

<sup>2</sup>Agroecotechnology Department, Faculty of Agriculture, Universitas Sriwijaya, Indralaya 30622, Ogan Ilir, South Sumatra, Indonesia.

<sup>3</sup>Agronomy Department, Faculty of Agriculture, Universitas Sriwijaya, Indralaya 30622, Ogan Ilir, South Sumatra, Indonesia.

\*Corresponding author: [weri.herlin@unsri.ac.id](mailto:weri.herlin@unsri.ac.id)

### ABSTRAK

Aplikasi pupuk bokashi dan pestisida nabati merupakan strategi efektif untuk meningkatkan produktivitas tanaman sekaligus mendukung sistem pertanian berkelanjutan. Penelitian ini mengkaji peran ganda kirinyuh; *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae), yang dimanfaatkan baik sebagai pupuk bokashi maupun pestisida nabati, dalam meningkatkan pertumbuhan dan hasil cabai merah (*Capsicum annuum* L.; Solanaceae). Percobaan dilakukan dengan rancangan acak kelompok (RAK) dua faktor. Faktor pertama adalah pupuk bokashi dengan dua taraf: 200 g per tanaman dan 600 g per tanaman. Faktor kedua adalah pestisida nabati dengan empat konsentrasi: 0 g L<sup>-1</sup>, 150 g L<sup>-1</sup>, 200 g L<sup>-1</sup>, dan 250 g L<sup>-1</sup>. Parameter yang diamati meliputi tinggi tanaman, waktu berbunga, waktu berbuah, bobot rata-rata buah, dan jumlah buah. Hasil penelitian menunjukkan bahwa pupuk bokashi dari *C. odorata* berpengaruh nyata terhadap pertumbuhan dan hasil, dengan dosis 600 g per tanaman memberikan hasil terbaik. Pestisida nabati juga berpengaruh signifikan, dengan konsentrasi 200 g L<sup>-1</sup> menghasilkan performa terbaik pada beberapa variabel. Meskipun interaksi kedua perlakuan tidak signifikan, kombinasi P2N2 memberikan hasil tertinggi secara keseluruhan. Temuan ini menunjukkan bahwa pupuk bokashi dan pestisida nabati dari *C. odorata* berpotensi menjadi alternatif untuk meningkatkan pertumbuhan dan produktivitas cabai merah dalam sistem budidaya berkelanjutan.

**Kata kunci:** cabai merah, kirinyuh, pestisida nabati, produksi tanaman, pupuk bokashi

### ABSTRACT

The application of bokashi fertiliser and botanical pesticides offers a sustainable approach to improving crop productivity. This study evaluated the effectiveness of *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae) as both a bokashi fertiliser and a botanical pesticide for enhancing the growth and yield of chilli (*Capsicum annuum* L.; Solanaceae). A randomised block design with two factors was employed. The first factor was bokashi fertiliser at two rates (200 and 600 g plant<sup>-1</sup>), while the second factor was botanical pesticide at four concentrations (0, 150, 200, and 250 g L<sup>-1</sup>). Observed variables included plant height, flowering time, fruiting time, average fruit weight, and fruit number. Bokashi fertiliser significantly affected chilli growth and yield, with 600 g plant<sup>-1</sup> producing the best results. Botanical pesticide application also showed significant effects, with 200 g L<sup>-1</sup> providing the most favourable performance across several parameters. Although no significant interaction was detected between the two treatments, the combination of 600 g plant<sup>-1</sup> bokashi fertiliser and 200 g L<sup>-1</sup> botanical pesticide produced the highest overall yield. These findings demonstrate the potential of *C. odorata*-based inputs for sustainable chilli cultivation.

**Keywords:** botanical pesticide, bokashi fertiliser, kirinyuh, red chilli, yield

## INTRODUCTION

Red chilli pepper is one of the strategic horticultural commodities that has high economic value globally, especially in Indonesia (Murtadho et al., 2024). The demand for red chilli pepper in Indonesia continues to increase annually, reaching 75.77% by household consumption (Aini et al., 2025). According to Badan Pusat Statistik (BPS), the production of red chilli pepper in 2025 reached 1,289,360.403 tons. However, this production level is still not proportional to the increasing demand for chilli peppers and tends to show fluctuating trends. The cultivation of chilli pepper in Indonesia often faces several challenges, particularly environmental problems caused by the excessive use of inorganic fertilisers and pesticides, which frequently leave harmful residues in the environment (Hapsoh et al., 2021). In addition, the cultivation of chilli pepper is often challenged by unpredictable climatic conditions and the increasing resistance of pests and diseases, which can lead to reduced crop yields (Sudarma et al., 2024). Therefore, the implementation of environmentally friendly cultivation practices is essential to overcome these problems

Sustainable agriculture emphasises the use of eco-friendly inputs, such as organic fertilisers and pesticides, which are safer and reduce the risk of environmental pollution (Garnida & Achmad, 2022). The use of organic materials for fertilisers and pesticides is commonly practiced because they utilise natural resources that are easily available, such as agricultural waste, organic matter, and weeds (Ramadahan et al., 2024; Bintang et al., 2025). One invasive weed that is easily found and has many benefits for agricultural cultivation is *kirinyuh* (Trisna et al., 2026). *Kirinyuh* is a fast-growing plant that can form dense shrubs and inhibit the growth of other plants. *Kirinyuh* is widely distributed in various areas such as plantations, rice fields, roadsides, and riverbanks (Okalia et al., 2022). *Kirinyuh* also has considerable potential in agriculture, such as being used as organic fertiliser, botanical pesticides, and natural herbicides (Permatasari & Asri, 2021). As an organic fertiliser, *kirinyuh* contains essential macronutrients such as N, P, and K, and also contains active compounds including flavonoids, tannins, alkaloids, and saponins (Diba et al., 2022). These compounds function as active agents that enhance plant growth and development and also act as biological control agents against pest attacks (Hafifah et al., 2025).

Various previous studies have shown that the use of *kirinyuh* bokashi fertiliser and botanical pesticides has significant effects on crop production and pest control. Bokashi fertiliser is used because it can improve soil fertility physically, chemically, and biologically, and is more environmentally friendly than inorganic fertilisers (Sihotang & Hanik, 2024). Compared to other organic fertilisers, bokashi has the advantage of being produced through a fermentation process using effective microorganisms (EM), making nutrients more readily available and easily absorbed by plants (Ciptono & Khoir, 2022). According to the results of research by Astuti et al., (2023) the F1 Gada chilli variety showed better results in terms of fruit length when treated with *kirinyuh* organic matter. According to research by Adlin et al. (2024) applying 600 g of *kirinyuh* bokashi fertiliser per plant resulted in the best growth in eggplant plants. *Kirinyuh* is not only used as bokashi fertiliser, but it can also be used as a botanical pesticide. Research by Saleh et al. (2022) and Habriantono et al. (2026) indicates that the use of *kirinyuh* leaf extract can

control infestations of fruit flies and whiteflies. Furthermore, the use of botanical pesticides derived from plants is relatively safer for natural enemies and leaves fewer residues that negatively impact the environment (Setiawati & Prastowo, 2022).

This study aims to analyse the effect of applying bokashi fertiliser made from *kirinyuh* (*Chromolaena odorata*) on the agronomic components of red chilli plants, including vegetative growth, generative development, and yield. The primary focus of this study is to determine the optimal dose of bokashi fertiliser for improving the agronomic performance of plants under conditions of limited soil fertility. Additionally, the use of botanical pesticides derived from *kirinyuh* in the form of extracts was applied as a supplementary treatment to control pest infestations, thereby creating more stable and productive growing conditions for the plants (Lisa et al., 2024). This integration of organic fertilisation and biological control is expected not only to improve input efficiency but also to have a positive impact on the sustainability of the cultivation system. Thus, this research is expected to produce practical, economical, and environmentally friendly chilli cultivation technology recommendations that are easy for farmers to apply in the field.

## METHODOLOGY

This study was conducted using an experimental field research approach. The tools used in this study included stationery, a blender, a hand sprayer, a watering can, a camera, buckets, thumbtacks, a measuring tape, a tarpaulin, manual and digital scales, and netting. The materials used in this study included water, Tangguh F1 chilli seeds, EM4, *kirinyuh* weeds (*Chromolaena odorata* L.), molasses, manure, 30 × 30 cm polybags, and rice husks.

### Studies sites and species sampling

This study was conducted in Rangkui District, Pangkal Pinang City. The study site is located at the coordinates -2.139571° LS and 106.102188° BT at an elevation of approximately 20 meters above sea level (FIGURE 1). The study was conducted from July 2025 until November 2025 using a 20 x 20 m plot of land.

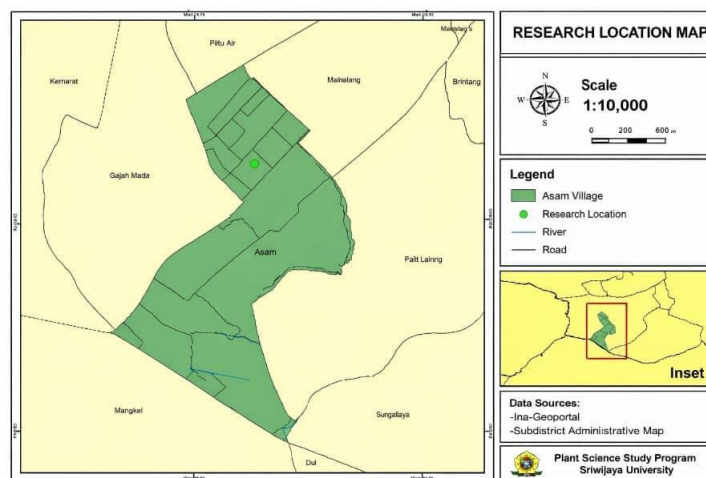


Figure 1. Map of the research location

## Experimental design

The study was organised using a factorial randomised block design that incorporated two variables. A total of 24 experimental units were established through three replications of each treatment, with five plants in each unit, resulting in 120 plants. Each unit consisted of five plants, giving a total of 120 plants. Observation samples were taken from three plants in each experimental unit, resulting in 72 observation samples. The first factor was bokashi fertiliser based on *kirinyuh* consisting of two levels: P1 = 300 g/plant and P2 = 600 g/plant. The second factor was botanical pesticide based on *kirinyuh* consisting of four levels: N0 = 0 g/l; N1 = 150 g/l; N2 = 200 g/l; and N3 = 250 g/l.

## Research procedures

The research procedures comprised several stages: (1) land preparation was undertaken by clearing weeds, plant debris, and rocks, levelling the soil surface, and installing protective netting around the study area; (2) bokashi fertiliser and botanical pesticide were prepared using *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae), with bokashi produced through fermentation using EM4 to distinguish it from conventional organic fertiliser, whereby fresh *kirinyuh* leaves were chopped to accelerate decomposition, and treatments consisted of P1 (9 kg *kirinyuh* weeds, 7.2 kg manure, 1.8 kg rice husks; 5:4:1) and P2 (18 kg *kirinyuh* weeds, 14.4 kg manure, 3.6 kg rice husks; 5:4:1), to which EM4 solution, molasses, and water were added before storage in drums for 1–2 weeks until the material turned dark black and crumbly, indicating successful bokashi formation, with application carried out once every two weeks according to the treatment dose; (3) botanical pesticide was prepared from fresh *kirinyuh* leaves weighed according to treatment levels (150 g, 200 g, and 250 g), blended with 1 L of water, filtered, and stored for 24 hours prior to application, then sprayed directly onto plants using a hand sprayer every two weeks; (4) planting involved sowing Tangguh F1 chilli seeds for 3–4 weeks before transplanting into polybags at 50 × 50 cm spacing; (5) maintenance included routine weeding, twice-daily watering, and pest and disease control using *kirinyuh*-based botanical pesticide; (6) observations were conducted one week after treatment initiation until harvest, recording plant height, flowering time, fruiting time, average fruit weight, and fruit number; and (7) harvesting was performed when the chilli fruits reached full maturity, indicated by a bright red colour.

## Data analysis techniques

The observational data were analysed using analysis of variance (ANOVA) at the 5% significance level in accordance with the factorial randomised block design (FRBD) to test the effects of bokashi fertiliser and *kirinyuh* botanical pesticide doses on the observed variables. If the ANOVA results indicated a significant difference, an Tukey's Honestly Significant Difference (Tukey's HSD) test at the 5% level was conducted to compare the treatment means.

## RESULTS AND DISCUSSION

### Height of red chilli plants

The results of observations on the height of red chilli plants, based on an analysis of variance, indicate that the effects of applying bokashi fertiliser and *kirinyuh* botanical pesticide were not significantly different (TABLE 1).

TABLE 1. Average height of red chilli plants

Treatment	Plant height (cm)						
	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP	7 WAP	8 WAP
P1N0	19.66 a	26.00 a	37.00 a	43.00 a	49.66 a	55.00 a	57.66 a
P1N1	19.00 a	26.00 a	35.66 a	44.33 a	49.66 a	55.00 a	58.00 a
P1N2	20.00 a	27.33 a	39.33 a	48.00 a	52.33 a	58.66 a	60.66 a
P1N3	19.66 a	25.66 a	35.33 a	43.66 a	50.66 a	56.66 a	59.66 a
P2N0	19.33 a	26.00 a	37.00 a	45.00 a	50.66 a	56.33 a	59.33 a
P2N1	19.33 a	26.66 a	38.00 a	49.66 a	52.33 a	59.00 a	60.66 a
P2N2	21.33 a	28.33 a	41.33 a	50.66 a	55.66 a	61.66 a	63.33 a
P2N3	20.33 a	28.00 a	40.66 a	46.66 a	53.66 a	60.66 a	62.66 a
Tukey's HSD (5%)	1.80	1.68	3.35	4.61	3.51	4.32	3.35

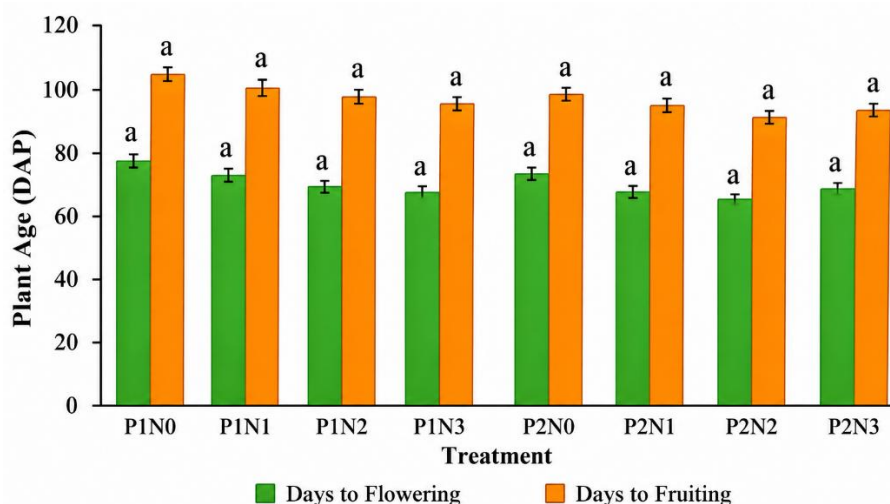
WAP = weeks after planting

Based on observations, the application of *kirinyuh* bokashi fertiliser and *kirinyuh* botanical pesticides had no significant effect on the height of red chilli plants 2–8 weeks after planting (WAP). This is indicated by the results of the 5% HSD test, which showed the same letter for all treatments. However, the average plant height across all treatments showed an increase at each observation time. At 8 WAP, the highest plant height was obtained in the P2N2 treatment, namely 63.33 cm, while the lowest was in the P1N0 treatment, namely 57.66 cm. The P2N2 treatment also showed better plant height compared to the other treatments.

The high growth of chilli plants in the P2N2 treatment was due to the plants receiving sufficient nutrients, allowing for more optimal nutrient uptake. Loose soil conditions allow roots to absorb water and nutrients more effectively, thereby enhancing plant growth (Seidel et al., 2022). According to research by Adlin et al., (2024), *Kirinyuh* bokashi fertiliser contains N, P, and K, which play a crucial role in the development of stems, leaves, and roots in plants. Sufficient nutrient availability enables plants to perform photosynthesis effectively, leading to better growth (Falaq et al., 2020). In addition to providing nutrients, organic fertilisers can improve the physical, chemical, and biological properties of the soil, allowing plant roots to develop better and nutrient uptake to become more optimal (Liu et al., 2026). Furthermore, when *kirinyuh* used as a botanical pesticide, contains secondary metabolites such as flavonoids, alkaloids, tannins, and saponins that have the potential to suppress the activity of plant pests (Ahmad et al., 2022).

### The flowering and fruiting stages of red chilli plants

The effects of bokashi fertiliser and botanical pesticides on the flowering and fruiting periods of red chilli plants are shown in FIGURE 2.



**FIGURE 2.** Flowering and fruiting stages of red chilli plants

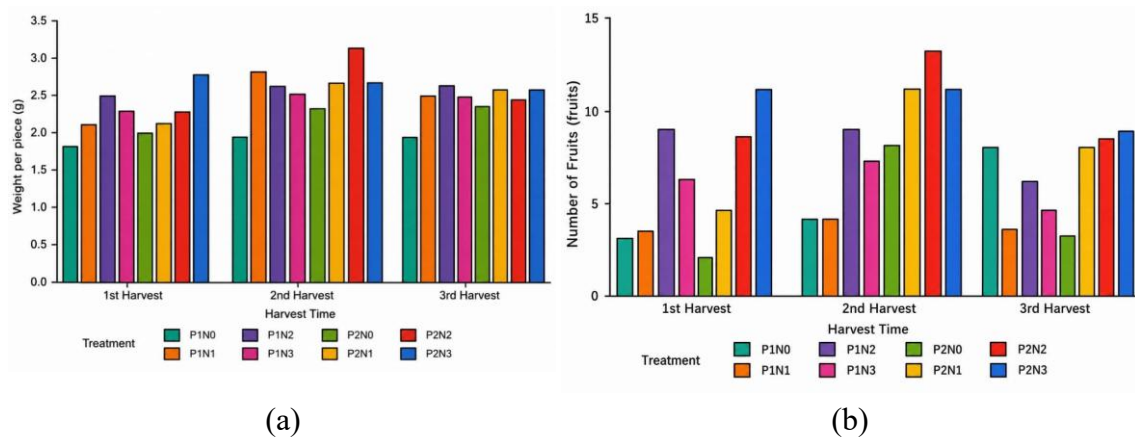
The results of the observations indicate that the application of bokashi fertiliser and botanical pesticide based on *kirinyuh* did not have a significant effect on the flowering and fruiting periods of red chilli plants. This is demonstrated by the results of the 5% HSD test, which showed the same notation across all treatments. Although not statistically significant, each treatment exhibited a trend toward different mean values. The P2N2 treatment showed a faster flowering and fruiting period compared to the other treatments, at 66 HSS and 92 HSS, respectively. In contrast, the P1N0 treatment showed the longest flowering and fruiting periods, at 77 HSS and 105 HSS.

Although there were no significant differences among the treatments, the P2N2 treatment tended to show earlier flowering and fruiting times compared to the other treatments. This is because available P and K play a crucial role in accelerating flower and fruit formation, thereby contributing to increased red chilli pepper production (Hapsah et al., 2021). Phosphorus acts as a carrier for metabolic energy transfer, supporting flowering and fruit development, while potassium plays an active role in various enzymes that aid translocation, thereby optimising flowering and improving fruit quality (Lestari et al., 2022). Sufficient nutrient availability supports the plant's generative development, allowing for more optimal flowering and fruiting processes.

### **Weight per piece and number of fruits on a red chilli plant**

The weight per piece and number of fruits produced chilli showed significant differences across the various treatments (FIGURE 3). Based on FIGURE 3A, the weight per red chilli fruit in each treatment showed variation in the first, second, and third harvests. In general, the weight per fruit tended to increase in the second harvest compared to the first harvest. The highest mean fruit weight was recorded in the P2N2 treatment during the second harvest, at around 3.1 g per fruit, while the lowest weight per fruit was found in the P1N0 treatment during the first harvest, at around 1.8 g per fruit. According to research Astuti et al., (2023), stated that the application of bokashi fertiliser can increase the fruit weight of chilli peppers. Phosphorus availability plays a crucial role in the formation of large fruits as it enhances the production of assimilates and the

availability of energy required by plants (Nugroho et al., 2022). The high fruit weight per fruit in the second harvest occurred because the plants were in an optimal production phase, allowing photosynthesis and the translocation of photosynthetic products to the fruit to occur more effectively. Additionally, the nutrients available from bokashi fertiliser have undergone more complete decomposition, allowing them to be optimally absorbed by the plants to support fruit formation. Furthermore, the decrease in fruit weight per fruit in the third harvest occurred due to reduced nutrient availability, thereby diminishing the plants' ability to produce large-sized fruits.

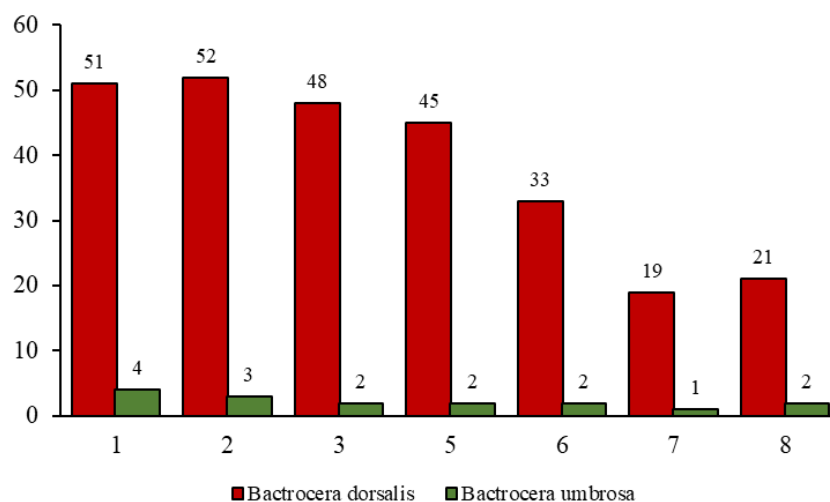


**FIGURE 3.** Chilli pepper crop yields in terms of (a) weight per piece and (b) number of fruits

**FIGURE 3B.** shows the number of red chilli peppers in the first, second, and third harvests. The highest number of fruits was obtained in the P2N2 treatment during the second harvest, while the lowest number of fruits was found in the P2N0 treatment. The number of fruits increased from the first harvest to the second harvest and then decreased in the third harvest. According to Mareza et al., (2021), the greater the number of fruits per plant, the greater the total fruit weight per plant, which in turn affects crop yield. All plants will grow well and produce high yields if all applied nutrients are available in sufficient quantities (Jailani, 2022). This indicates that plant productivity peaks during the second harvest. The increase in fruit yield during the second harvest occurs because the plants have entered their optimal generative phase, allowing for maximum flower and fruit formation.

### Pest insect populations on red chilli plants

According to **FIGURE 4**, the pest insect populations found on red chilli plants showed variations in numbers at each observation time. *Bactrocera dorsalis* (Diptera: Tephritidae) was the most dominant pest found on chilli plants compared to *Bactrocera umbrosa*.



**FIGURE 4.** Pest insect populations on red chilli plants

The population of *B. dorsalis* at the start of the observation reached 51–52 individuals, while *B. umbrosa* ranged from only 3–4 individuals. At several observation times, the numbers of both pest species showed a decreasing trend until the seventh week. The *B. dorsalis* population decreased to 19 individuals, while *B. umbrosa* decreased to 1 individual. This decline in pest populations indicates that the application of the *kirinyuh* botanical pesticide has the potential to reduce pest populations on chilli plants. The decline in pest populations during the observation period indicates that the *kirinyuh* botanical pesticide has the potential to influence pest presence on chilli plants. This is due to the presence of secondary metabolites in *kirinyuh*, such as flavonoids, alkaloids, tannins, and saponins, which can act as antifeedants, repellents, or toxins against insects (Afifah et al., 2024). These compounds can affect pest activity, resulting in a decreasing number of individuals observed during the study (Yurenza & Apriyadi, 2023).

## CONCLUSIONS

The application of bokashi fertiliser and botanical pesticide influenced the growth and yield of red chilli plants. The P2N2 treatment (600 g of bokashi fertiliser per plant and 200 g/L of botanical pesticide) showed higher values for plant height, flowering time, fruiting time, fruit weight, and number of fruits compared to the other treatments. In addition, the populations of *Bactrocera dorsalis* and *Bactrocera umbrosa* tended to decline during the observation period. Therefore, the use of bokashi and botanical pesticides has the potential to become a more environmentally friendly alternative for red chilli cultivation.

## AUTHOR CONTRIBUTIONS

W.H., A.K., D.K.D.: project conception; W.H., A.K.: methodology; D.K.D.: data analyses; D.K.D.: original manuscript draft; W.H., A.K., D.K.D.: manuscript review and editing.

## ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to Mr Sudarmadi and Mrs Eva Andriani for their invaluable assistance and support during the implementation of the research, field observations, and data collection, which greatly contributed to the successful completion of this study.

## CONFLICTS OF INTEREST STATEMENT

There are no conflicts to declare.

## ETHICAL COMPLIANCE

This study involved the use of *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae) and chilli (*Capsicum annum* L.; Solanaceae), both of which are plant species. As no animals, humans, or sensitive materials were involved, the research did not require ethical approval or certification.

## REFERENCES

- Adlin, S. melsky, Syamsuwirman, & Taher, yonny arita. (2024). Uji dosis bokashi kirinyuh (*Chromolaena odorata*) terhadap pertumbuhan dan hasil tanaman terung ungu (*Solanum melongena* L.). *Jurnal Research Ilmu Pertanian*, 4(1), 1–8. <https://doi.org/10.31933/gd295r95>.
- Afifah, P. H., Wagiono, & Adhi, S. R. (2024). Pengaruh pemberian pestisida nabati terhadap intensitas serangan hama penting pada tiga varietas tanaman kedelai (*Glycine max* (L.) Merrill). *Jurnal Agroplasma*, 11(1), 101–110. <https://doi.org/10.36987/agroplasma.v11i1.5714>.
- Ahmad, J., Lamangantjo, C. J., Uno, W. D., & Husain, I. H. (2022). Potential of siam weed (*Chromolaena Odorata*) as fertilizer and liquid pesticide and its applications to increase crop production. *Jurnal Biologi Tropis*, 22(2), 415–424. <https://doi.org/10.29303/jbt.v22i2.3108>.
- Aini, L.N., Putra, B.J.R., & Aditama, F.N.D. (2025). Identification of land characteristics to increase red chili productivity in Mangunan, Bantul, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 1302(1). <https://doi.org/10.1088/1755-1315/1302/1/012025>.
- Astuti, P., Hafsa, S., & Hayati, E. (2023). Pemanfaatan bahan organik kirinyuh (*Chromolaena odorata* L.) terhadap komponen hasil beberapa varietas cabai besar (*Capsicum annum* L.) IPB. *Jurnal Agrotek Lestari*, 9(2), 172–182. <https://doi.org/10.35308/jal.v9i2.7341>.
- Bintang, G. P., Herlin, W., & Irsan, C. (2025). Natural pest control diversity on *Oryza sativa* L.(Poaceae) managed in organic and conventional cultivation systems in Desa Tegal Sari, Ogan Komering Ulu Timur, South Sumatera. *Bioma*, 21(2), 86-96. <https://doi.org/10.21009/bioma.v21i2.54756>.
- Ciptono, E. bahtiyar, & Khoir, M. (2022). Composition analysis of bokashi organic fertilizer from fish flour fishery waste. *Journal Agraricus*, 2(1), 14–23. <https://doi.org/10.32764/agaricus.v2i1.2767>.
- Diba, F., Nauli, U. R., Winarsih, W., & Oramahi, H. A. (2022). The potency of kirinyuh (*Chromolaena odorata* L.) and Kemangi leaf (*Ocimum basilicum*) as biopesticide against *Schizophyllum commune* Fries. *Jurnal Biologi Tropis*, 1(22), 304–314. <https://doi.org/10.29303/jbt.v22i1.3023>.
- Falaq, F. Al, Juanda, B. R., & Siregar, D. S. (2020). Respon pertumbuhan dan hasil

- tanaman terung (*Solanum melongena* L.) terhadap dosis pupuk organik cair gdm dan pupuk organik padat. *Jurnal Agrosamudra*, 7(2), 1–13. <https://doi.org/10.33059/jupas.v7i2.3014>.
- Garnida, Y., & Achmad, W. (2022). Organic agriculture: sustainable agriculture solutions in providing food for the community. *Jurnal Ekonomi*, 11(03), 2127–2131. <https://ejournal.seaninstitute.or.id/index.php/Ekonomi/article/view/2421>.
- Habriantono, B., Nusantara, A. P., & Nurlaelita, K. (2026). Uji efektivitas minyak parafin dan ekstrak daun kirinyu (*Chromolena odorata*) terhadap mortalitas hama kutu kebul (*Bemisia tabaci*). *Jurnal Ilmiah Inovasi*, 26(1), 1–7. <https://publikasi.polije.ac.id/jii/article/view/6511>.
- Hafifah, Nazirah, L., & Nazaruddin, M. (2025). The use of *Chromolaena odorata* green manure to improve chemical properties of degraded inceptisols and growth and yield of peanut. *Journal of Degraded and Mining Lands Management*, 12(4), 8295–8303. <https://doi.org/10.15243/jdmlm.2025.124.8295>.
- Hapsoh, Dini, & Ulfah. (2021). Application of biofertilizer and local *Beauveria bassiana* Vuillemin on growth, production and resistant of red chili plants (*Capsicum annuum* L.). *Journal of Physics: Conference Series*, 782(4), 042033. <https://doi.org/10.1088/1742-6596/2049/1/012040>.
- Jailani. (2022). Pengaruh pemberian pupuk kompos terhadap pertumbuhan tanaman tomat (*Lycopersicon esculentum* Mill.). *Jurnal Sains Dan Aplikasi Volume*, 10(1), 1–8. <https://doi.org/10.32672/jss.v10i1.4079>.
- Lestari, P., Abdurrahman, T., & Sasli, I. (2022). Pengaruh konsentrasi pupuk organik cair kulit buah-buahan terhadap pertumbuhan dan hasil tanaman okra merah pada tanah gambut. *Jurnal Sains Pertanian Equator*, 11(3). <https://doi.org/10.26418/jspe.v11i3.58108>.
- Lisa, O., Lizmah, S. F., Sari, P. M., & Mustaqim, M. (2024). Insecticidal effects of the pandanus (*Pandanus amaryllifolius* Roxb. ex Lindl.; Pandanaceae) leaf powder against rice weevil (*Sitophilus oryzae* Linnaeus 1753; Curculionidae). *Bioma*, 20(2), 65-72. <https://doi.org/10.21009/bioma.v20i2.49336>.
- Liu, Q., Yang, L., Ma, L., & Zhai, Y. (2026). Effects of organic fertilizers on soil properties in arid zones and their mechanism of action. *Frontiers in Environmental Science, February*, 14:1681958. <https://doi.org/10.3389/fenvs.2026.1681958>.
- Mareza, E., Agustina, K., & Syukur, M. (2021). Keragaan agronomi cabai keriting (*Capsicum annuum* L.) IPB di lahan pasang surut sumatera selatan. *Jurnal Agronomi Indonesia*, 49(2), 169–176. <https://doi.org/10.24831/jai.v49i2.36005>.
- Murtadho, I. R., Prasetyowati, K., Tunas, U., & Surakarta, P. (2024). Marketing chain analysis of big red chilli (*Capsicum annuum* L.) in kedawung district, sragen regency. *Journal of Rural and Urban Community Studie*, 2(2), 83–88. <https://doi.org/10.36728/jruacs.v2i2.4010>.
- Nugroho, B., Musa, N., & Rahim, Y. (2022). Effect of Siam Weed (*Chromolaena odorata*) Organic Fertilizer on the Growth and Yield of Lettuce (*Lactuca sativa* L.). *Jurnal Lahan Pertanian Tropis*, 1(1), 12–16. <https://doi.org/10.56722/jlpt.v1i1.15139>.
- Okalia, D., Andriani, D., & Marlina, G. (2022). Potential of kirinyuh weed (*Chromolaena odorata*) as a source of green fertilizer in two district in Kuantan Singingi District. *Jurnal Agronomi Tanaman Tropika (Juatika)*, 4(2), 139–148. <https://doi.org/10.36378/juatika.v4i2.2393>.
- Permatasari, S. celia, & Asri, M. tri. (2021). Efektivitas ekstrak ethanol daun kirinyuh (*Eupatorium odoratum*) terhadap mortalitas larva Spodoptera litura. *Jurnal Unesa*, 10, 17–24. <https://doi.org/10.26740/lenterabio.v10n1.p17-24>.
- Ramadhan, K. I., Setyadi, A. R., Haryuni, H., & Priyadi, S. (2024). Sustainable

- agriculture education through processing tobacco stem into liquid organic fertilizer. *Journal of Community Capacity Empowerment*, 3(1), 25–28. <https://doi.org/10.36728/jcce.v3i1.4569>.
- Saleh, T. S., Lamangantjo, C. J., & Retnowati, Y. (2022). Pengaruh ekstrak daun gulma Siam (*Chromolaena odorata*) terhadap mortalitas lalat buah (*Drosophilla melanogaster*). *Seminar Nasional Teknologi, Sains Dan Humaniora, 2022*(SemanaTECH), 346–351. <https://doi.org/10.30869/semantech.v4i1.1050>.
- Seidel, S. J., Gaiser, T., Srivastava, A. K., Leitner, D., Schmittmann, O., Athmann, M., Kautz, T., Guigue, J., & Ewert, F. (2022). Simulating root growth as a function of soil strength and yield with a field-scale crop model coupled with a 3d architectural root model. *Frontiers in Environmental Science*, 13(May), 1–19. <https://doi.org/10.3389/fpls.2022.865188>.
- Setiawati, T. C., & Prastowo, S. (2022). Pemanfaatan tanaman refugia sebagai pestisida nabati untuk mengurangi serangan hama pada sistem budidaya hidroponik. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, 7(6), 807–813. <https://doi.org/10.33084/pengabdianmu.v7i6.3870>.
- Sihotang, D. R., & Hanik, N. R. (2024). Analysis of NPK content in several solid bokashi fertilizers. *Jurnal Biologi Tropis*, 1(25), 334–340. <https://doi.org/10.29303/jbt.v25i1.8492>.
- Sudarma, I. M., Perdana, P., Wiguna, K., Agung, A., Wulandira, A., & Djelantik, S. (2024). Mitigation and adaptation of chili farmers to climate change in Baturiti District , Bali Province, Indonesia. *International Journal of Design and Nature and Ecodynamics*, 19(4), 1391–1403. <https://doi.org/10.18280/ijdne.190432>.
- Trisna, I. K., Dinata, A., Widaningsih, D., & Darmiati, N. N. (2026). Potensi ekstrak etanol daun kirinyuh (*Chromolaena odorata* L.) untuk mengendalikan ulat grayak (*Spodoptera litura* F.) (Lepidoptera : Noctuidae) pada tanaman kacang panjang (*Vigna sinensis* L.). *Journal on Agriculture Science*, 16(1), 61–71. <https://doi.org/10.24843/>.
- Yurenza, N., & Apriyadi, R. (2023). Potensi oleoresin gulma daun siam (*Chromolaena odorata*) pada mortalitas hama lalat buah (*Bactrocera cucurbitae*) pada uji in-vitro. *Jurnal Penelitian Biologi*, 08(1), 8–16. <https://doi.org/10.33019/ekotonia.v8i1.4072>.