

THE EFFECT OF BIOLOKA BIOFERTILIZER CONCENTRATION THROUGH SPRAYING ON THE GROWTH AND YIELD OF FIVE VARIETIES OF ORNAMENTAL CHILI (*CAPSICUM ANNUUM L.*)

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Abstract

This study examined the effect of Bioloka biofertilizer concentration (0 ml/L as control and 10 ml/L) through spraying on the growth and yield of five varieties of ornamental chili (*Capsicum annuum L.*): *Syakira*, *Ayasha*, *Nazla*, *Viola*, and *Violeta* . The study was conducted in Cinta Damai Village, Babel District, Southeast Aceh Regency, from August to December 2025, using a 2x5 factorial Randomized Block Design (RBD) with three replications. Seedlings were sown for 21 days until they had 4-6 leaves, then transferred to 15 cm pots with soil, compost, and rice husk charcoal (1:1:1) media. Bioloka spray treatment was given weekly 7 times (20 ml/plant), with observation parameters including plant height (15, 30, 45, 60 HST), stem diameter, and flowering age. Analysis of variance showed significant to highly significant effects on most parameters, such as plant height (F=11.162 at 15 DAP), stem diameter (except at 30 DAP, F=2.095), and flowering age (F=24.481). 10 ml/L Bioloka concentrate significantly increased vegetative growth and flowering through natural hormones, supporting sustainable ornamental chili cultivation by reducing dependence on chemical fertilizers.

Keywords : Bioloka biofertilizer, ornamental chili, growth plants, factorial RAK, Southeast Aceh.

INTRODUCTION

Ornamental chili peppers (*Capsicum annum L.*) are showing increasing popularity in Indonesia, not only as ornamental plants that beautify the environment with their diverse colors and fruit shapes, but also as agricultural commodities with potential economic value (Firmansyah et al., 2022). Awareness of the nutritional benefits and bioactive compounds contained in ornamental chili peppers, such as vitamin C, carotenoids, and other antioxidant compounds, is also driving market demand for this commodity (Rahmawati et al., 2023). Therefore, efforts to increase the productivity and quality of ornamental chili peppers are crucial to meet growing market demand and improve farmers' welfare.

Balanced nutrient availability is also a key factor in supporting optimal growth and development of ornamental chili plants. Macronutrients, such as nitrogen (N), phosphorus (P), and potassium (K), play a vital role in various plant metabolic and physiological processes. Nitrogen is a major component of proteins, nucleic acids, and chlorophyll, which are essential for vegetative growth and photosynthesis (Hidayat et al., 2021). Phosphorus plays a role in energy transfer, nucleic acid synthesis, and root system development

(Kurniawan et al., 2022). Potassium plays a role in osmotic regulation, enzyme activation, and sugar transport (Setiadi et al., 2020).

Although numerous studies have examined the role of hormones and nutrients in increasing plant productivity, research specifically exploring the optimization of combinations of fertilization hormones and nutrient management in various ornamental chili varieties in Indonesia remains limited. Most previous studies tend to focus on the use of hormones or nutrients alone, without considering the complex interactions that may occur between various types of hormones and nutrients (Sulistyo et al., 2019). Furthermore, the specific responses of various ornamental chili varieties to different hormone and nutrient treatments are also not fully understood.

Bioloka organic fertilizer is an innovative approach that can provide significant benefits in improving soil health and agricultural sustainability. This fertilizer contains live microorganisms that function to increase nutrient availability, improve soil structure, and enhance plant resistance to environmental stress. By combining the use of Bioloka organic fertilizer with the appropriate application of fertilization hormones, it is hoped that an optimal combination can be found that not only increases ornamental chili yields but also strengthens the variety's resistance to disease and changing climate conditions. Further research is needed to understand the mechanisms of this interaction and develop practical recommendations for farmers cultivating ornamental chilies in Indonesia.

In contrast to previous studies that used a combination of hormones (auxin, gibberellin, cytokinin) and nutrients (N, P, K) on growth, the study to be conducted aims to examine the effect of Bioloka organic fertilizer on the growth, fruiting, and fruit quality of five different ornamental chili varieties in Indonesia. Bioloka organic fertilizer is a product that combines elements of organic fertilizer and biological fertilizer, designed to improve soil fertility and support sustainable plant growth. The use of Bioloka organic fertilizer is expected to provide a more sustainable and environmentally friendly alternative in ornamental chili cultivation, as well as improve product quality and safety for consumers.

The author's motivation for conducting this research was the underexplored potential of Bioloka organic fertilizer in the context of ornamental chili peppers in Indonesia, as well as the need to find more sustainable and efficient agricultural solutions to increase crop yields and quality. This research is expected to significantly contribute to the development of more environmentally friendly agricultural practices and reduce dependence on synthetic chemical fertilizers.

RESEARCH METHODS

The study used a factorial Randomized Block Design (RAK) with two factors: ornamental chili varieties (Syakira, Ayesya, Nazla, Viola, Violeta) and the concentration of Bioloka organic fertilizer, which contains natural hormones (auxins for roots and cell elongation, gibberellins for stem growth and flowering, cytokinins for cell division and shoots), minerals, and soil-improving microbes. Each treatment was repeated 3 times (5 varieties × 6 concentrations = 30 treatment units, each with 10 plants), resulting in a total of 90 experimental units.

Table 1 Treatment Combinations

No	Combination of treatments	Treatment	
		Biology mL/L	Chili varieties
1.	B ₀ V ₁	Control	Shakira
2.	B ₀ V ₂	Control	Ayesha
3.	B ₀ V ₃	Control	Nazla
4.	B ₀ V ₄	Control	Viola
5.	B ₀ V ₅	Control	Violet
6.	B ₁ V ₁	10	Shakira
7.	B ₁ V ₂	10	Ayesha
8.	B ₁ V ₃	10	Nazla
9.	B ₁ V ₄	10	Viola
10.	B ₁ V ₅	10	Viola

Description: B= Violin (B), V= Variety (V).

The tools that will be used in this research are spoons, watering cans, gray paper, hoes, digital scales, thermometers, *cutters*, stationery, scissors, *seed trays*, 15 cm pots, *sprayers*, cameras, and Soil Plant Analysis Development (SPAD). The materials that will be used in this research are seeds of five varieties of chili, namely Syakira, Ayesha, Nazla, Viola and Violeta. Bioloka biofertilizer, topsoil, compost, rice husk charcoal, and fertilizers with balanced nitrogen, phosphorus, and potassium content, and mineral-based liquid fertilizers.

The research procedure is that chili seeds are soaked in warm water at 40°C for 30 minutes, incubated in a damp cloth for 12 hours to increase germination, then sown in a 21-day tray with soil, compost, and burnt rice husks (1:1:1), 1.5 cm deep per hole (1 seed), watered until the field using a hand sprayer in the morning and evening. The land is prepared with a mixture of topsoil: compost: rice husk charcoal (1:1:1) for nutrition, soil structure, aeration, and drainage, inserted into a 15 cm perforated pot. Seedlings are transplanted in the third week (4-6 true leaves) in the afternoon to avoid wilting. Bioloka treatment: 10 ml/990 ml of water, spray the leaves in the morning (20 ml/plant, 7 times a week) until flowering. Maintenance includes watering in the morning with a watering can until saturated (skip if it rains), replanting dead plants, manual weeding, and pest/disease control with Diafentiuron+Deltametrine pesticides if necessary. Observations: plant height (meter) and stem diameter (vernier caliper) at 15, 30, 45, 60 days after planting; flowering age from first bloom to 50% open flowers.

Data analysis in this study will be conducted using analysis of variance (ANOVA). ANOVA is used to test whether there is a significant effect of the treatment (application of Bioloka organic fertilizer) on various observed parameters that have been measured, both vegetative growth parameters and generative growth parameters. If the ANOVA results show a significant difference between treatments on the observed parameters (for example, a p-

value <0.05), then the analysis will be continued with further testing. The further test that will be used is the Honestly Significant Difference Test (HSD). This further test aims to determine which treatment provides a statistically significant difference in the observed parameters measured. Thus, it can be determined which concentration of Bioloka organic fertilizer treatment provides the best effect on the growth and fruiting of ornamental chilies.

RESULTS AND DISCUSSION

Recapitulation of Various Fingerprints

This section presents a recapitulation of the analysis of variance (ANOVA) of research data using factorial RAK, to test the real effect of single factors and interactions (ornamental chili varieties and Bioloka concentration) on growth parameters, as well as flowering. The calculated F value compared to the F table ($\alpha=5\%$) as the basis for determining significant treatments in five varieties.

Table 2. Summary of the results of the analysis of variance (F test) .

No	Parameter	F Count	Is.
1	Plant Height 15 Plants Per Plant (cm)	11.162	**
2	Plant Height 30 Plants Per Plant (cm)	2.967	*
3	Plant Height 45 HSPT (cm)	4.339	**
4	Plant Height 60 HSPT (cm)	3.671	*
5	Stem Diameter 15 HSPT (cm)	7.086	**
6	Stem Diameter 30 HSPT (cm)	2.095	tn
7	Stem Diameter 45 HSPT (cm)	4.402	*
8	Stem Diameter 60 HSPT (cm)	4.312	**
9	Flowering Age (HST)	24.481	**

Description: * = has a significant effect at the 5% level, ** = has a very significant effect at 1%, tn = no effect, real impact,

The F ANOVA test results table shows the effect of ornamental chili varieties and Bioloka concentration on growth parameters. Plant height at 15 days after planting ($F = 11.162^{**}$), 30 days after planting ($F = 2.967^{*}$), 45 days after planting ($F = 4.339^{**}$), and 60 days after planting ($F = 3.671^{*}$) was significant to very significant, indicating that the treatment effectively increased vertical growth throughout the vegetative phase. Similarly, stem diameter: very significant at 15 days after planting ($F = 7.086^{**}$) and 60 days after planting ($F = 4.312^{**}$), significant at 45 days after planting ($F = 4.402^{*}$), but not significant at 30 days after planting ($F = 2.095$ tn), possibly due to the transition phase without strong differentiation. Flowering age was very significant ($F = 24.481^{**}$), confirming that the treatment accelerated generative initiation. Overall, 8 of the 9 parameters were significant ($\alpha = 5\%$), proving the benefits of the treatment on plant vigor .

Quantitative Characteristics

Plant Height (cm)

A recapitulation of the analysis of variance showed that ornamental chili varieties and Bioloka biofertilizer affected various plant heights at 15, 30, 45, and 60 days after planting—significantly significant in some phases, but insignificant in others. The average per treatment is shown in Table 3 as a basis for interpreting the effect on the vegetative growth of the five varieties.

Table 3. Average height of ornamental chili plants aged 15, 30, 45, and 60 days after planting

No	Treatment	Plant Height (cm)			
		15 HST	30 HST	45 HST	60 HST
1	B0V1	6.13 ^{bcd}	14.97 ^{ab}	16.40 ^a	18.93 ^a
2	B0V2	6.20 ^{bcd}	19.40 ^{ab}	15.33 ^a	18.53 ^a
3	B0V3	4.60 ^{ab}	17.03 ^{ab}	13.73 ^a	18.20 ^a
4	B0V4	3.37 ^a	14.37 ^{ab}	16.07 ^a	20.53 ^{ab}
5	B0V5	5.87 ^{bcd}	20.97 ^b	22.27 ^{ab}	26.30 ^{ab}
6	B1V1	4.60 ^{ab}	13.80 ^{ab}	18.97 ^b	22.83 ^{ab}
7	B1V2	7.13 ^{cd}	14.47 ^{ab}	23.07 ^{ab}	25.30 ^{ab}
8	B1V3	5.20 ^{abc}	11.10 ^a	19.53 ^{ab}	22.73 ^{ab}
9	B1V4	5.20 ^{abc}	13.13 ^{ab}	16.20 ^a	19.17 ^a
10	B1V5	7.80 ^d	18.50 ^{ab}	27.63 ^b	31.97 ^b
BNJ		1.19	4.88	4.84	5.66

Description: Numbers followed by the same letter in the same column indicate no significant difference based on the BNJ test at the 5% level.

Table 3 shows that the height of ornamental chili plants at 15, 30, 45, and 60 days after planting (DAP) showed different responses between treatments. At 15 days after planting, plant height ranged from 3.4–7.8 cm, with treatment B1V5 producing the highest height and significantly different from the other treatments, while B0V4 showed the lowest height. At 30 days after planting, plant height ranged from 11.1–20.0 cm, with treatment B0V5 producing the highest height and significantly different from B1V3, but not significantly different from several other treatments. Entering the age of 45 days after planting, plant height ranged from 13.7–27.6 cm, with treatment B1V5 again showing the highest height that was significantly different from treatments with lower growth. At 60 days after planting, plant height ranged from 18.2–31.0 cm, with B1V5 still showing the highest growth and significantly different from the other treatments, while most treatments were in the group that was not significantly different.

Overall, the Bioloka treatment on the V5 variety (B1V5) showed the best plant height growth across all observation periods, indicating that the combination of variety factors and biofertilizer application influenced the increase in plant vegetative growth. This difference in response is thought to be caused by differences in the genetic potential of the varieties and the ability of Bioloka to increase the availability of nutrients and growth hormones in plants.

This is in line with the opinion of Aliyah et al. (2024) who stated that plant height growth is strongly influenced by the interaction between genetic factors, nutrient availability, soil microbial activity, and growing environmental conditions.

Stem Diameter (mm)

The results of the analysis of variance recapitulation showed that the Bioloka biofertilizer treatment and ornamental chili varieties had different effects on stem diameter at each observation age. Stem diameter is an important parameter that describes the strength and ability of plants to support vegetative and generative growth. Stem diameter measurements were carried out at 15, 30, 45, and 60 days after planting (DSP) to determine the plant response to Bioloka application and genetic variation between varieties. The average stem diameter of ornamental chili plants for each treatment is presented in Table 4 below as a basis for interpreting the effect of Bioloka.

Table 4. Average stem diameter of ornamental chili plants aged 15, 30, 45, and 60 days after planting

No	Treatment	Bar diameter (mm)			
		15 HST	30 HST	45 HST	60 HST
1	B0V1	1.03 ^c	1.90 ^a	3.50 ^{ab}	4.00 ^{abc}
2	B0V2	1.03 ^c	2.23 ^a	4.03 ^b	4.43 ^{bc}
3	B0V3	0.50 ^{ab}	1.07 ^a	2.60 ^a	3.47 ^a
4	B0V4	0.43 ^a	1.57 ^a	3.73 ^{ab}	4.30 ^{abc}
5	B0V5	1.07 ^c	2.43 ^a	4.23 ^b	4.37 ^{abc}
6	B1V1	0.73 ^{abc}	2.00 ^a	3.60 ^{ab}	4.00 ^{abc}
7	B1V2	1.10 ^c	2.47 ^a	4.27 ^b	4.83 ^c
8	B1V3	0.63 ^{abc}	1.67 ^a	3.27 ^{ab}	4.00 ^{abc}
9	B1V4	0.93 ^{bc}	2.10 ^a	3.40 ^{ab}	3.90 ^{ab}
10	B1V5	1.10 ^c	2.33 ^a	3.83 ^b	4.40 ^{bc}
BNJ		0.51	1.08	1.18	0.90

Description: Numbers followed by the same letter in the same column indicate no significant difference based on the BNJ test at the 5% level.

Table 4 shows that at 15 days after planting, stem diameter ranged from 0.4 mm to 1.1 mm, where treatments B0V5, B1V2, and B1V5 had the largest diameter of 1.1 mm and were significantly different from B0V4 which had the lowest diameter of 0.4 mm, while the other treatments were in the medium diameter range and were not significantly different from each other. At 30 days after planting, stem diameter growth ranged from 1.1 mm to 2.5 mm and showed no significant difference between all treatments, indicating that stem growth at this phase was still relatively uniform. Entering the age of 45 days after planting, stem diameter increased with a range of 2.6 mm to 4.2 mm, where treatments B0V5 and B1V2 had the highest diameter and were significantly different from B0V3, indicating that the application of Bioloka began to have a positive effect on stem enlargement in certain varieties. At the age of 60 HST, the highest stem diameter was found in the B1V2 treatment, namely 4.8 mm and was significantly different from B0V3 (3.4 mm), while several other treatments such as

B0V5, B1V5, and B0V2 also had relatively large stem diameters without significant differences from each other.

Overall, the application of Bioloka organic fertilizer, especially on V2 and V5 varieties, has been proven to be able to increase the stem diameter of ornamental chili plants, especially in the advanced growth phase, in accordance with the theory that plant vegetative growth is influenced by the balance of nutrients, growth hormones, soil microbial activity, and the genetic potential of the variety, so that the use of organic fertilizers such as Bioloka can be a sustainable alternative in increasing the growth and productivity of ornamental chili plants (Nasution, 2017).

Flowering Age (Days)

The results of the analysis of variance recapitulation showed that the Bioloka biofertilizer treatment and different varieties had varying effects on the flowering time in ornamental chili plants. Observations on the flowering time were carried out from the appearance of the first flower until 50% of the plants in each treatment showed flowering, with the time of flower emergence recorded in each replication to observe variations between varieties and treatments. The analysis results showed that some treatment combinations were able to accelerate flower emergence, while other combinations showed a slower flowering time. The flowering time for each treatment is presented in Table 5 below as a basis for interpreting the effect of Bioloka on the efficiency of the generative phase in five ornamental chili varieties.

Table 5. Average flowering age of ornamental chilies

No	Treatment	Flowering age (days)
1	B0V1	31
2	B0V2	28
3	B0V3	33
4	B0V4	31
5	B0V5	27
6	B1V1	29
7	B1V2	25
8	B1V3	28
9	B1V4	27
10	B1V5	24

Description: Numbers followed by the same letter in the same column indicate no significant difference based on the BNJ test at the 5% level.

Table 5 shows that the flowering age of ornamental chili peppers varies between 24 and 33 days, with the fastest flowering age being found in treatments B1V5 (24 days) and B1V2 (25 days), indicating that the application of Bioloka organic fertilizer to varieties V5 and V2 can accelerate the transition of plants from the vegetative phase to the generative phase. Treatments B1V3, B1V4, and B0V5 are in the middle flowering age group (26–27 days), which also shows a tendency for acceleration, although not as fast as B1V5 and B1V2. Conversely, the slowest flowering age was found in B0V3 (33 days) and B0V1 (31 days),

indicating that without Bioloka application, plants take longer to enter the flowering phase. Other treatments such as B0V2, B0V4, and B1V1 are in the middle group (28–31 days).

These results indicate that Bioloka plays a role in accelerating flowering, especially in responsive varieties, by increasing the availability of nutrients and plant metabolic activity; nitrogen plays a role in early vegetative growth, while phosphorus and potassium greatly influence the process of flower formation and development, so that the combination of nutrient balance and genetic potential of the variety determines how quickly or slowly the plant enters the generative phase (Gulo et al., 2024; Age, 2017).

CONCLUSION

Analysis of variance showed significant to highly significant effects on plant height ($F=11.162$ at 15 DAP), stem diameter (except 30 DAP), and flowering age ($F=24.481$). Weekly spraying effectively stimulated metabolism through natural hormones such as auxin and gibberellin in Bioloka. Selecting the right variety combined with Bioloka supports sustainable cultivation of ornamental chilies in Southeast Aceh, reducing dependence on chemical fertilizers. Further research is recommended for optimal dosages and genetic interactions of varieties.

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