Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi dan Biologi
Vol. 8, Issue 2, December 2025
Pages: 322 – 330

p-ISSN: 2621-3702
e-ISSN: 2621-7538

Response of Dayak onion (*Eleutherine bulbosa* Merr.) plant growth after application of biosaka from the Asteraceae family

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ABSTRACT

Public interest in the use of medicinal plants continues to grow. One of the medicinal plants that has been developed is dayak union (*Eleutherine bulboba* Merr.), which is believed to be able to cure various diseases. This research aims to determine the best growth response of Dayak onion after the application of biosaka from the Asteraceae family. The main implications of biosaka for agriculture are significant cost efficiency in production, improved plant and soil health, and the promotion of sustainable and environmentally friendly farming by improving land ecosystems. Biosaka is made by taking 60 g of each plant and then grinding it until it is dark brown and slightly foamy. Biosaka extraction produces approximately 20 ml. The experiment was conducted at the Faculty of Mathematics and Natural Sciences, University of North Sumatra from December to March 2025. The design used in this experiment is a Completely Randomized Design (CRD) consisting of 5 treatment levels of biosaka concentration, namely 0 ml/L, 3.5 ml/L, 4.5 ml/L, 5.5 ml/L, and 6.5 ml/L with eight replications. The data obtained were analyzed using SPSS version 22 software with ANOVA (Analysis of Variance) test. If the treatment has a significant effect, it is followed by DMRT (Duncan Multiple Range Test). The research results show that the application of a biosaka concentration of 6.5 ml/L yielded the highest results and had a significant effect on plant height, number of leaves, tuber diameter and number of shoots and tubers per clump.

Keywords: Asteraceae, biosaka, Dayak onion, medicinal plants

INTRODUCTION

Indonesia has abundant biodiversity with various types and has potential as medicinal plants. The utilization of natural materials has become a back-to-nature issue and tends to be the choice of the Indonesian people. Moreover, this is supported by the prolonged economic crisis and the relatively high cost of medical treatment, which has led the community to turn to traditional medicine (Safiah et al., 2024).

Dayak onion also known as sabrang onion (*Eleutherine bulbosa* Merr.), is a plant commonly found in Indonesia and widely used as a medicinal plant. The Karo people commonly use this plant as a remedy for asthma and wounds. But they still consider this plant a weed in their cultivation areas. Empirically, Dayak onion is capable of curing various diseases, such as breast cancer, hypertension, diabetes mellitus, low cholesterol, ulcers, colon cancer, stroke prevention, and reducing stomach pain after childbirth (Septian et al., 2019). The part of the dayak onion that is often used is the tuber. In the tuber of dayak onion, there are phytochemical compounds such as alkaloids, glycosides, flavonoids, phenolics, steroids, and tannins. Additionally, the leaves can also be utilized as an alternative. This utilization is related to the phytochemical content and secondary metabolites possessed by Dayak onions (Jardin, 2015).

Plants produce various types of secondary metabolites to attract insects, pollinators like bees, or to protect themselves against herbivore and pest attacks (Nurlita et al., 2024). The secondary metabolites of dayak onions include flavonoids, naphthoquinones, and several of their derivatives. Naphthoquinone is often

associated with antifungal, antiparasitic, antiviral, antimicrobial, antioxidant, and anticancer activities (Prayitno & Mukti, 2018).

Figure 1. Dayak onion (*Eleutherine bulbosa* Merr.)

The application of liquid organic fertilizers can also help improve the efficiency of inorganic fertilizer use by enhancing the physical, chemical, and biological properties of the soil and having a significant impact on crop yields. Additionally, these fertilizers can meet soil nutrient needs, act as growth stimulants, and serve as pest control agents, making them suitable for use as decomposers. Currently, farmers tend to use synthetic or chemical pesticides more than plant-based pesticides, because synthetic pesticides are mass-produced and readily available, and they have a quick killing effect but can trigger environmental damage, non-target animal deaths, simplification of natural food chains and biodiversity, bioaccumulation or biomagnification, pest resistance, and the killing of natural enemies (Rukmana et al., 2024).

The raw materials used in making biosaka consist of 5 different species of the Astraceae family. Various plants have been studied to contain elicitors, namely Jotang kuda (*Synedrella nodiflora*), Gletang (*Tridax procumbens)*, Sawi langit (*Cyanthillium cinereum*), Kirinyuh (*Chromolaena odorata*), and Bandotan (*Ageratum conyzoides),* which produce secondary metabolites potentially used as sources of resistance genes against pests and pathogens.

Biosaka is one of the renewable technology systems in the development of modern organic agriculture. Biosaka is one of the Liquid Organic Fertilizers made from a mixture of perfectly healthy grass or leaf mash (Pertiwi, 2022). The benefits of using Biosaka include being environmentally friendly, cost-effective, and economical in fertilizer usage, reducing the use of chemical pesticides, decreasing pest and disease attacks, making the land more fertile, and minimizing environmental impact (Banu, 2020). Additionally, Biosaka can shorten the harvest period, thereby increasing productivity and improving the quality of production. Biosaka has several advantages, one of which is its production process that does not involve microbes or fermentation, and does not require advanced technology (Maruapey et al., 2023). The content found in the analyzed biosaka includes nutrients N, P, K, Ca, Mg, and organic matter (Azhari et al., 2023).

Elicitor is a substance in plants that contains biological compounds capable of increasing phytoalexin production when applied to plants or plant cell cultures. Elicitors can originate from bacteria, fungi, viruses, polymer compounds, carbohydrates, proteins, fats, and mycotoxins as biotic elicitors. Elicitors can trigger physiological, morphological responses, and the accumulation of phytoalexins as molecules that activate signal transduction and cause the activation and expression of genes related to the biosynthesis of secondary metabolites (Nasution, 2024).

An important aspect to consider in the production of Biosaka Elicitor is the selection of the right materials, which involves utilizing various types of leaves from 5 to 7 different plant or grass species that are in good condition, meaning they do not show holes or spots indicating insect bites or pest and disease attacks. The parts of the plants used for making Biosaka Elicitor are the leaves and grass.

This research aims to determine the growth response of Dayak onions after the application of biosaka from the Asteraceae family, and it is expected that biosaka from natural elicitors made from grass materials can improve fertilization roles, reduce chemical residues, and enhance the growth of dayak onions.

METHOD

The research was conducted at the Faculty of Mathematics and Natural Sciences, University of North Sumatra from December to March 2025. Dayak onions were taken from the gardens of the Berastagi community, Karo. This study used a Completely Randomized Design (CRD) and applied 5 biosaka treatments with different spraying methods, namely B0 = Control, B1 = Biosaka 3.5 ml/L, B2 = Biosaka 4.5 ml/L, B3 = Biosaka 5.5 ml/L, B4 = 6.5 ml/L with 8 replications.

The research implementation includes land preparation, which first involves clearing the area of plant debris and rocks, and then removing them from the research site. After the land is clean, planting is carried out using compost as the growing medium, which is placed in polybags.

Making biosaka

Plants from the Asteraceae family, namely Jotang kuda (*Synedrella nodiflora*), Gletang (*Tridax procumbens*), sawi langit (*Cyanthillium cinereum*), kirinyuh (*Chromolaena odorata*), and Bandotan (*Ageratum conyzoides*), were taken from their young leaves, washed thoroughly, and then crushed by hand. Each of the obtained plants was weighed at 60 g. The grinding was carried out for about 15-25 minutes until the weeds were finely ground and the juice was extracted. The maceration is stopped when the color has become a homogeneous dark brown and slightly foamy (Azhimah et al., 2023). Biosaka extraction from 300 g of Asteraceae family yielded approximately ± 20 ml.

Plant treatment and maintenance

Treatment spraying is done every 4 days, starting from the first day after planting (DAP). Biosaka is applied using a sprayer with the nozzle directed toward the plants and positioned about 0.5 meter away. The biosaka solution is sprayed once during the first application and the quantity of spraying increases as the plants grow (Table 1). Each spray contains approximately 0.5 ml of biosaka solution.

Table 1. Spraying biosaka solution

Spraying Time	Test
Day 4 DAT	1x spray
Day 8 DAT	2x spray
Day 12 DAT	3x spray
Day 16 DAT	4x spray
Day 20 DAT	5x spray
Day 24 DAT	6x spray
Day 28 DAT	7x spray
Day 32 DAT	8x spray
Day 36 DAT	9x spray
Day 40 DAT	10x spray, etc.

Spraying with biosaka is stopped when the plants are 72 days after planting with 18 sprays, or 3 days before harvest. Plant maintenance, such as regular watering, was carried out twice a day until the observation period ended (11 WAP). Then, weeding was done once a week by pulling out the weeds that grew inside the polybags.

Dayak onion can be harvested when it is 11 weeks old. Harvesting is done in the morning to reduce evaporation. Another sign that the leaves are ready to harvest is that some of the lower parts of the leaves have turned yellow or dried out, and the number of scallion shoots is 7–10. Harvesting can be done by pulling up the onions that have turned red.

Data analysis

The data obtained were analyzed using SPSS version 22 software with ANOVA (Analysis of Variance) test. If the treatment has a significant effect ($p < 0.05$), it will be followed by DMRT (Duncan Multiple Range Test).

RESULTS AND DISCUSSION

Plant height and number of leaves

The results of the ANOVA test analysis showed that the growth response of Dayak onions after biosaka treatment from the Asteraceae family was significant ($p < 0.05$) effect on plant height, number of leaves. The results of the measurement of several growth parameters are displayed in Table 2.

Table 2. Plant height, number of leaves, of Dayak onion (*Eleutherine bulbosa* Merr.) with the application of biosaka from the Asteraceae family .

Treatment	Plant Height (cm)	St.Dev	Number of Leaves (sheet)	Sd.Dev
B_0	33.625^{a}	3.77	12.250^{a}	3.61
B_1	37.250^{ab}	4.23	17.50^{b}	2.77
B_2	39.375^{b}	3.66	23.875^{c}	4.7
B_3	40.500^{b}	4.53	30.625^{d}	3.66
B_4	49.125^{c}	6.35	35.750^{e}	6.01

Plant height is a parameter that is observed directly every week to understand the growth and development of the plants. The variable plant height showed significant differences, which was due to the application of biosaka treatment considering the right time to provide nutrients, specifically in the morning, which helps reduce evaporation in the plants. According to Triadiawarman et al. (2022), the nutrient needs of plants during their growth and development vary, because during the growth and development process they have different intensities, so the application of fertilizers cannot be done at arbitrary times and needs to consider the required nutrients and their types. The soil's nutrient availability has a big impact on plant development and production.

The highest height of the dayak onion plants was observed with the biosaka treatment at 6.5 ml/L (B4), with an average height of 65.0 cm, while the lowest height was found in the control treatment (B0) with an average plant height of 33.625 cm. this is because at that dosage, the plants utilize nitrogen most effectively. The nitrogen element functions in the formation of assimilates and carbohydrates. The carbohydrates that have been formed are used to create new cells, cell elongation, and tissue thickening during the vegetative phase. The increased carbohydrate supply is directly proportional to the rate of cell division, cell elongation, and rapid tissue formation, resulting in the rapid growth of plant height.

Foliar fertilizers can stimulate plant growth because they contain a lot of nutrients N, P, and K. These nutrients are needed to help plants grow well and achieve maximum yields. The nitrogen (N) element plays a role in assisting the photosynthesis process, which will subsequently be used during the vegetative growth phase to form new cells, elongate cells, and thicken tissues. The N element also affects the growth of root meristems (terminal meristems), which produce new cells at the meristem between the root tips, leading to an increase in plant height (Setiawati et al., 2018).

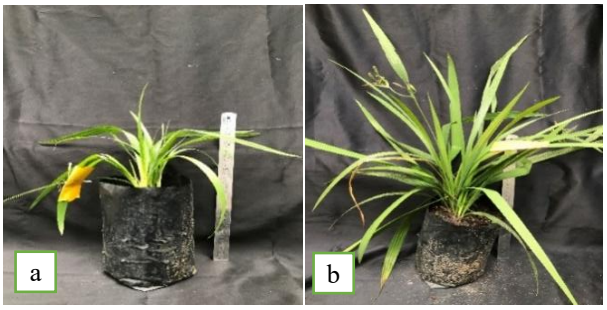

Figure 2. (a) The lowest height of Dayak onion plants with treatment B0 (Control); (b) The tallest Dayak onion plants with treatment B4 (Biosaka 6.5 ml/L).

The average number of leaves of the dayak onion plant, which was the highest at 35.750 leaves, was found in the treatment with biosaka 6.5 ml/L (B4) and was significantly different from the control (B0). The use of biosaka is considered effective because the nutrients provided can be directly absorbed by the leaves. According to the research by Butler et al. (2020); Zhu et al. (2020), fertilizer sprayed on the leaves will directly enter the stomata, and then be transferred to other plant organs by the vascular tissue. The N element contained in biosaka can accelerate growth, including leaf development, stem size, and dark green color, as well as promote vegetative growth above ground,

thereby increasing the number of leaves. The increase in nitrogen dosage is followed by an increase in the number of leaves. With the increase in nitrogen dosage, the meristematic tissue at the shoot tip becomes more active, resulting in the production of more leaves. Low nitrogen levels result in insufficient protoplasm formation, leading to disrupted growth and fewer leaves being produced.

According to Triadiawarman et al. (2022), foliar fertilizer is an inorganic liquid fertilizer that contains macro and micro nutrients, where both elements have been combined in certain proportions. The macro nutrient content of foliar fertilizer is N 11% P 10% K 6% and the micro nutrients are: Fe, Mn, Cu, and Zn. The biosaka treatment on plant height and leaf count showed significantly different results, indicating a plant response due to the addition of biosaka dosage in each treatment. The increase in plant height will be accompanied by an increase in the number of leaves due to the addition of macro and micro nutrients contained in the fertilizer. The increased application of NPK fertilizer will enhance the growth parameters of onion plants (Sukmawan & Riniarti, 2022).

Bulb diameter, number of shoots and bulbs

The results of the ANOVA test analysis showed that the growth response of Dayak onions after biosaka treatment from the Asteraceae family was significant ($p < 0.05$) effect on bulb diameter and the number of shoots and bulbs per clump. The results of the measurement of several growth parameters are displayed in Table 3.

In Table 3, it can be seen that the increase in biosaka concentration can increase the bulb diameter of dayak onions. At a biosaka concentration of 6.5 ml/L, it can produce optimal dayak onion yields of 3.2. The increase in tuber diameter is due to the improper planting distance arrangement. Proper technical activities in adjusting the planting distance can affect the competitive ability and productivity of Dayak onion plants.

Table 3. Bulb diameter, number of shoots, and bulbs of Dayak onion (*Eleutherine bulbosa* Merr.) with the application of biosaka from the Asteraceae Family.

Treatment	Bulb Diameter (cm)	St. Dev	Number of Shoots and Bulbs	St. Dev
B_0	2.075^{a}	0.34	1.750^{a}	0.70
B_1	2.337^{a}	0.45	2.500^{ab}	0.53
B_2	2.412^{ab}	0.40	3.250^{b}	0.88
B_3	2.862^{bc}	0.57	4.375^{c}	1.06
B_4	3.200^{c}	0.43	5.750^{d}	1.16

Therefore, in future research, it is necessary to investigate the ideal planting distance for dayak onions. Dayak onions have a wide canopy, and precise planting distance information is essential to prevent the onion canopies from overlapping. The presence of an optimal planting distance is needed to improve growth and yield (Arumsari & Suwarto, 2018); (Asbur et al., 2019). Planting too closely together results in a high plant population, which can affect both the production and quality of the plants.

The application of biosaka treatment, which is only done every 4 days, can also affect the plants, as they receive sufficient nutrients. The element that greatly influences the diameter of the Dayak onion bulb is calcium (Ca), which plays a role in cell division and elongation, as well as regulating the distribution of photosynthetic products. Calcium is a strengthening component that regulates permeability and maintains cell walls. Its role is very important at the root growth point. Even if there is a calcium deficiency, root formation and growth will be disrupted, resulting in hindered nutrient absorption.

The analysis results of the number of shoots and tubers were significantly different and showed that the treatment with biosaka at a concentration of 6.5 ml/L (B4) produced the highest number of shoots and tubers with an average of 5.750 clumps, while the control treatment (B0) resulted in the lowest number of shoots and tubers with an average of 1.750 clumps. The increase in the number of shoots and tubers of dayak onions at a biosaka

concentration of 6.5 ml/L is suspected to be due to this concentration being optimal for providing the best influence on the metabolic process, thereby stimulating the vegetative growth of the plants (Afif et al., 2014). Plant growth is better with high auxin content, which can stimulate callus formation, cell elongation, root initiation, and embryogenesis induction (Pagalla et al., 2025; Tambunan et al., 2025).

The element that greatly affects the number of seedlings is Phosphorus (P) because Phosphorus is one of the essential nutrients needed by plants for optimal growth and yield. Phosphorus is a component of enzymes, proteins, ATP, RNA, DNA, and phytin, which play important roles in the processes of photosynthesis, sugar and starch utilization, and energy transfer. The P element also plays a role in the growth of buds, roots, flowers, and fruits. Phosphorus deficiency can cause the growth of plant leaves to shrink, become stunted, and eventually fall off, with slow growth phases and the plants becoming dwarfed. If phosphorus (P) deficiency occurs, it can disrupt the absorption of other elements, especially micronutrients like iron (Fe), copper (Cu), and zinc (Zn), and can affect the formation of young leaves.

The concentration of nutrient content (N, P, K) in biosaka is in accordance with the needs of the plants, allowing them to grow and develop better. Similarly, the addition of NPK elements greatly affects soil and plant fertility. The better absorption of N, P, and K elements will ultimately increase plant height, leaf count, tuber diameter, and the number of shoots and tubers per clump. The N element is an important component in the formation of amino acids, amides, nucleotides, and nucleoproteins, and is essential for cell enlargement and division (Jhanji & Sekhon, 2018). The P element increases carbohydrate content, root elongation, and the number and size of tubers, thereby increasing crop yield. Element K plays a role in assisting the photosynthesis process where organic compounds are transported to the tubers and produce high-quality tubers (Siswanto, 2019).

Chlorophyll content

The analysis results show that the biosaka treatment from the Asteraceae family has a significant effect ($p<0.05$) on the chlorophyll content as seen in Table 4.

Table 4. Chlorophyll content of Dayak onion (*Eleutherine bulbosa* Merr.) with the application of biosaka from the Asteraceae family.

Treatment	Std. deviasi	Total Chlorophyll (mg/l)
B_0	0.06	0.152^a
B_1	0.13	1.154^b
B_2	0.09	1.221^b
B_3	0.22	1.379^c
B_4	0.08	1.531^d

Based on Table 4, it was found that the dayak onion plants responded to the biosaka treatment by increasing chlorophyll content compared to the control. In the biosaka treatment of 6.5 ml/L (B4), the content of total chlorophyll increased compared to B0 (control). Some studies, such as those by Huda & Rosmala (2025), indicate that biosaka enhances plant metabolism and physiology, which has implications for increased total chlorophyll.

Biosaka affects the increase in plant chlorophyll because it functions as an elicitor, containing several bioactive compounds that can increase nitrogen and phosphorus nutrients, thereby increasing chlorophyll levels. According to (Augustien & Suhardjono, 2017), chlorophyll content is influenced by nitrogen and phosphorus nutrients. (Luziatelli et al., 2019), recent research found that various plant-derived bioactive compounds significantly increased the chlorophyll content and fresh weight of lettuce cells. This increase in chlorophyll makes plants more efficient at capturing sunlight and converting it into energy for growth, which impacts overall plant productivity.

Higher plants have two types of chlorophyll, including chlorophyll a and chlorophyll b (Nio Song & Banyo, 2011). Hormones are naturally available in plants, but they still need to be used on plants to increase root capacity, accelerate root growth, improve

the quantity and quality of roots, and reduce the variability in the quantity and quality of root coefficients. This then influences plant growth.

According to Setiawati et al. (2018), the recommended fertilizer dosage for each plant also varies. Chlorophyll is synthesized through the photoreduction of protochlorophyllide to chlorophyllide a, followed by the esterification of phytol to form chlorophyll a. Chlorophyll a is also found in leaves with a reddish-brown color, but in small amounts. Next, xanthophyll is formed through the combination of oxygen molecules with carotene, causing the leaves to change color to yellowish-green. According to (Maulid, 2015), the factors that influence the formation of chlorophyll include genes, light, and the elements N, Mg, and Fe as the components and catalysts in the synthesis of chlorophyll. All green plants contain chlorophyll a and chlorophyll b.

Treatment with a biosaka elicitor may impact the plant's capacity for photosynthetic activity. Photosynthesis, protein synthesis, enzyme activity, and nutrition absorption are all significantly impacted by phenolic substances derived from plant secondary metabolites (Humbal & Pathak, 2023). The amount of sunlight captured will be impacted by a high chlorophyll content. This affects the light-dependent processes' photosynthetic activity.

The research results show that using biosaka as an elicitor allows plants to absorb nutrients better, resulting in improved growth and production. Therefore, biosaka functions to enhance the physiological activity of plants, which impacts their growth. Beside functioning as an elicitor, biosaka also contains the hormones auxin, gibberellin, and cytokinin (Kartika et al., 2024). The information gathered from this investigation suggests that the elicitors found in biosaka can only be used to increase physiological activity. Plants are known to produce assimilates and store them in all of their organs through a physiological process called photosynthesis (Nasrudin & Isnaeni, 2022).

CONCLUSION

The Biosaka application from the Asteraceae family increases the growth of Dayak onions and is effective in improving Dayak onion growth in terms of plant height, number of leaves, number of shoots, bulb diameter, number of bulbs per clump, and total chlorophyll. Among the various types of doses administered, the 6.5 ml/L dose (B4) had a significant effect on the growth response of Dayak onions. In future research, it is recommended to increase the dosage of biosaka for further study, considering that the highest treatment in this article yielded the highest results. The primary effects of biosaka on agriculture include increased plant and soil health, significant cost savings in production (by lowering the need for pricey chemical fertilizers), and the promotion of environmentally friendly and sustainable farming by enhancing land ecosystems and even stimulating plant growth without weed control.

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