

ANALYSIS OF GROWTH AND YIELD OF GRAIN MAIZE (*ZEAMAYS L.*) THROUGH THE APPLICATION OF BIOSAKA ELICITORS DERIVED FROM VARIOUS WEED SPECIES ON DYSTRUDEPT SOIL

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ABSTRACT

Corn (*Zea mays L.*) is one of Indonesia's strategic food commodities after rice, serving as a food source, animal feed, and industrial raw material. This study tested various types of botanical elicitors on the productivity of grain corn plants grown on Dystrudept soil. The method used was a factorial randomized block design (RBD) with three factors: weed type (G_0 = No Weeds, G_1 = Babadotan (*Ageratum conyzoides*), G_2 = Pakisan (*Diplazium esculentum*), and G_3 = Mixed Weeds (Babadotan + Pakisan)), Application Frequency (I_1 = Weekly, I_2 = Every 2 Weeks, and I_3 = Every 3 Weeks), and Biosaka Concentration (D_1 = 20 ml/16 L water, D_2 = 40 ml/16 L water, and D_3 = 60 ml/16 L water). The results showed that the application of the Pakisan weed-based elicitor (G_2) significantly produced the highest yield, namely 1.54 kg/plot and 3.85 tons/ha. The application of the elicitor at a concentration of 60 ml per 16 L of water clearly produced the best response in terms of vegetative growth, particularly as measured by the number of leaves (10.15 leaves) and leaf area (641.70 cm²).

KEYWORDS: Biosaka, Weed-based elicitor, Dystrudept soil, Shelled corn (*Zea mays L.*)

1. INTRODUCTION

Corn (*Zea mays L.*) is one of Indonesia's strategic food commodities after rice, serving as a food source, animal feed, and industrial raw material. National corn production in 2023 was recorded at 14.46 million tons with a harvested area of 2.49 million hectares, but decreased by 12.50% compared to 2022 (BPS, 2023). This decline in production continued in the following months, with corn production falling to 1.17 million tons in November and dropping further to 0.89 million tons in December 2023. For January–February 2024, production is projected to decline further to 0.56 million tons (BPS, 2024).

This situation warrants serious attention, given that 94.88% of the national corn supply is used by industry, primarily the animal feed industry. A decline in production could lead to rising feed prices, which would ultimately affect the prices of meat and eggs from

commercial chickens. One type of soil widely used for corn cultivation in Indonesia is Dystrudept soil, a group within the Inceptisols order. Dystrudept soils have characteristics including: low soil pH and base saturation < 60%, low organic matter content, unstable structure especially in the lower layers low cation exchange capacity, and susceptibility to erosion on sloping terrain (Soil Survey Staff, 2014; Brady & Weil, 2008; Hardjowigeno, 2003).

These characteristics result in Dystrudept having low natural fertility, making plants prone to physiological stress and suboptimal growth without improvements in soil management. To address this issue, sustainable agricultural technologies are needed that can enhance plant resilience and productivity without relying on synthetic fertilizers. One emerging approach is the use of botanical elicitors. Elicitors are bioactive compounds that can stimulate plant defense mechanisms, enhance

metabolism, improve root growth, and strengthen plant responses to both abiotic and biotic stresses (Hammerschmidt, 1999).

Botanical elicitors are elicitors derived from plant extracts or essences, such as extracts from herbs, grasses, or specific plant parts. The bioactive compounds within them (*Phenolics, Flavonoids, Terpenoids, Alkaloids*, and others) work to activate the induced defense system, enhance photosynthetic efficiency, improve nutrient uptake, and ultimately increase crop productivity. This technology is also known to be environmentally friendly as it does not add chemical residues to the soil. One of the botanical elicitor innovations developing in Indonesia is Biosaka, which is made from a mixture of healthy plants crushed in water to produce signaling compounds (*Bio-signals*) that can stimulate plant resilience and metabolism. Biosaka differs from organic fertilizer because it does not function as a nutrient source but rather as a physiological activator for plants (Director General of Food Crops, 2023).

The use of botanical elicitors shows great potential for application in Dystrudept soils, which are characterized by high levels of abiotic stress and low fertility. Activating plant defense mechanisms through elicitors is expected to enhance maize plants' ability to utilize limited nutrients, improve tolerance to acidic soil conditions, and boost vegetative and generative growth through the grain-filling stage.

Given these various issues such as declining corn production, soil fertility degradation caused by synthetic fertilizers, the negative characteristics of Dystrudept soil, and the potential of botanical elicitors as an environmentally friendly agricultural technology it is necessary to conduct research on the effects of applying various types of botanical elicitors on the productivity of grain corn grown in Dystrudept soil.

2. MATERIALS AND METHODS

2.1. Research Location

This study was conducted at the experimental plot of the Faculty of Agriculture, University of Islam Sumatra Utara (3.5317° LU 98.6620° BT), located at Jln. Karya Wisata, Gedung Johor, Medan Johor District, Medan City, North Sumatra Province, at an elevation of approximately 35 meters above sea level, on flat terrain.

2.2. Tools and Materials

The materials used were weeds collected from the study area, shelled corn seeds (*Zea mays* L.) of the Betras 10 variety, Babadotan weeds, Pakisan weeds, urea fertilizer, TSP fertilizer, KCl fertilizer, compost, insecticides, fungicides, bamboo, and chemicals for nutrient analysis. The equipment used included an analytical balance, an oven, paper, pruning shears, a cell phone, a sprayer, measuring cups, bamboo, signs, and other supporting tools.

The method used in this study was a factorial RAK design consisting of 3 (three) factors. The first factor was weed type (G), namely G0 = No Weeds, G1 = Babadotan (*Ageratum conyzoides*), G2 = Pakisan (*Diplazium esculentum*), and G3 = Mixed Weeds (Babadotan + Pakisan). The second factor is application frequency (I), namely I1 = Weekly, I2 = Every 2 weeks, and I3 = Every 3 weeks. The third factor is Biosaka concentration (D), namely D1 = 20 ml/16 L of water, D2 = 40 ml/16 L of water, and D3 = 60 ml/16 L of water.

2.3. Observed Variable

Observations conducted on corn (*Zea mays* L.) include

- Number of Leaves (Pieces). Leaf count observations were conducted when the plants were 2 weeks old by counting the number of fully expanded leaves. Leaf count observations were conducted every 2 weeks and discontinued once the plants entered the generative growth stage (*Flowering*).
- Leaf Area (cm²). Leaf area measurements were taken when the plants were 2 weeks old by measuring the leaf area using a ruler or measuring tape. Leaf area measurements were taken every two weeks. Leaf area was calculated using the following formula

$$LD = P \times L \times x$$

Description
 LD = Leaf Area
 P = Leaf Length (cm)
 L = Leaf Width (cm)
 C = Constanta (0,78)
- Flower Day (day). Flowering-day observations are conducted by counting the number of days from seed planting until the corn plants begin to produce flowers. Flowering-day observations are based on approximately 80% of the plants.
- Yield per plot with cobs (kg). Yield observations per plot with cobs were conducted by weighing all the corn on the cob using a scale with a minimum capacity of 5 kg.

3. RESULTS

3.1. Number of Corn Leaves (Pieces)

Based on the results of the analysis of variance (ANSIRA) presented in Appendices 6, 7, and 8, it was found that the Biosaka concentration treatment had a significant effect on the number of leaves observed in dent corn (*Zea mays indentata*) plants. In contrast, the weed type treatment, application intensity, and treatment interactions did not significantly affect the number of leaves on dent corn plants. However, there were differences in the number of leaves across the treatments. This can be seen in Table 1 and Figure 1 below.

Table 1: Average Number of Leaves at 2–6 Weeks After Sowing in Indentata Corn (*Zea mays* L.) Plants.

Treatment	Weeks After Planting (WAP)		
	2	4	6
Types of Weeds (G)	----- Pieces -----		
G0 (Control)	4.40	6.40	9.40
G1 (<i>Ageratum conyzoides</i>)	4.85	6.85	9.85
G2 (<i>Diplazium esculentum</i>)	4.91	6.91	9.91
G3 (<i>A. conyzoides</i> + <i>D. esculentum</i>)	4.75	6.75	9.75
Spraying Intensity (I)			
I1 (Every week)	4.67	6.67	9.67
I2 (2 Once a week)	4.56	6.56	9.56
I3 (3 Once a week)	4.95	6.95	9.95
Elisistor Concentration (D)			
D1 (20 ml/16 L water)	4.56 ab	6.56 ab	9.56 ab
D2 (40 ml/16 L water)	4.47 a	6.47 a	9.47 a
D3 (60 ml/16 L water)	5.15 b	7.15 b	10.15 b

Note : Numbers followed by different letters in the same column differ significantly at the 0.05 BNT level.

Table 1 shows an increase in the number of leaves on corn plants as the plants aged from 2 to 6 days after sowing during the treatment period. This indicates that the vegetative phase of the corn plants proceeded normally, as evidenced by the increasing formation of Leaves the primary organs of photosynthesis even though the treatment had a significant effect only on the elicitor concentration (D) applied but did not have a significant effect on the weed type (G) or spraying intensity (I).

Among the weed type treatments (G), the highest average number of leaves was observed in the treatment using Pakisan weed extract (G2), at 9.91 leaves, while among the spraying frequency treatments (I), the highest average number of leaves was observed in the treatment with a spraying frequency of once every three weeks, at 9.95 leaves. Meanwhile, the concentration (D) treatment that significantly affected the average number of leaves can be seen in Table 1 above and Figure 1 below.

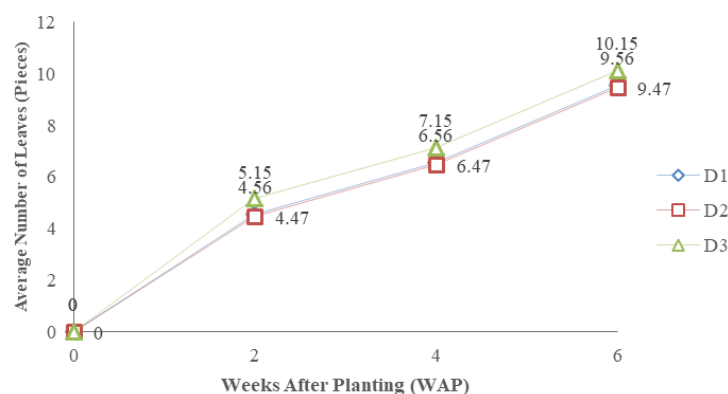
**Figure 1: Observation of the Number of Leaves at 2–6 MST.**

Table 1 above shows that the average number of leaves in treatments D1 and D2 did not differ significantly at any observation time, but there was a significant difference between treatments D2 and D3 at every observation time. These results are clearly illustrated in Figure 1, which shows that the average number of leaves increases as the plants age; however, it is noted that the lowest average number of leaves was observed at a Biosaka concentration of 40 ml/16 L of water, at 9.47 leaves. Meanwhile, the highest average was observed at a Biosaka concentration of 60 ml/16 L of water, at 10.15 leaves. As the number of leaves increases up to a maximum limit, the plants will perform photosynthesis optimally. According to Djamas (2023), Biosaka contains quinone compounds that play a crucial role in

various plant processes, including photosynthesis, pigment formation, energy production, and metabolic regulation. All of these processes can affect leaf number and quality; thus, at a concentration of 60 ml per 16 L of water, the application of the elicitor can have a significant effect on the observed number of leaves at 2, 4, and 6 weeks after sowing.

According to the findings of Akbar *et al.* (2024), the Biosaka treatment resulted in a higher average number of leaves compared to the control treatment. These results are also consistent with those of Kartika *et al.* (2024), who found that the Biosaka treatment had a significant effect on the number of leaves (at 2, 8, and 10 weeks after sowing).

3.2. Leaf Area (cm²) of Corn Plants (*Zea mays* L.)

The results of the analysis of variance (ANSIRA) presented in Appendices 9, 10, and 11 indicate that the treatment involving concentration (D) and the combination of concentration with the application

intensity of biosaka (D × I) can influence the leaf growth of dent corn (*Zea mays indentata*). These results are shown in Table 2 and illustrated in Figures 2 and 3 below.

Table 2: Average Leaf Area (cm²) at 2–6 MST in Sweet Corn (*Zea mays* L.) Plants.

Treatment	Weeks After Planting (WAP)		
	2	4	6
Types of Weeds (G)	-----cm ² -----		
G0 (Control)	119.45	289.18	565.88
G1 (<i>Ageratum conyzoides</i>)	144.52	324.20	612.05
G2 (<i>Diplazium esculentum</i>)	146.71	329.67	621.07
G3 (<i>A. conyzoides</i> + <i>D. esculentum</i>)	137.85	315.67	600.87
Spraying Intensity (I)			
I1 (Every week)	143.44	322.49	609.36
I2 (2 Once a week)	132.04	307.38	590.33
I3 (3 Once a week)	135.92	314.17	600.22
Elicitor Concentration (D)			
D1 (20 ml/16 L water)	131.89 ab	307.70 ab	591.01 ab
D2 (40 ml/16 L water)	121.88 a	291.12 a	567.20 a
D3 (60 ml/16 L water)	157.64 b	345.23 b	641.70 b
Concentration × Intensity			
D1I1 (20 ml/16 L air/ Every week)	127.81	301.50	582.58 ab
D1I2 (20 ml/16 L air/2 Once a week)	155.23	341.40	636.43 b
D1I3 (20 ml/16 L air/3 Once a week)	112.62	280.19	554.02 a
D2I1 (40 ml/16 L air/ Every week)	136.79	310.46	591.15 ab
D2I2 (40 ml/16 L air/2 Once a week)	107.57	270.18	539.11 a
D2I3 (40 ml/16 L air/3 Once a week)	121.29	292.73	571.34 ab
D3I1 (60 ml/16 L air/ Every week)	165.73	355.51	654.34 bc
D3I2 (60 ml/16 L air/2 Once a week)	133.32	310.56	595.46 ab
D3I3 (60 ml/16 L air/3 Once a week)	173.86	369.60	675.30 c

Note: Numbers followed by different letters in the same column differ significantly at the 0.05 BNT level.

Table 2 above shows an increase in the leaf area of corn plants as the plants aged from 2 to 6 days after sowing during the treatment period. This indicates that the vegetative phase of the corn plants proceeded normally, as evidenced by the increasing leaf area the site where photosynthesis occurs although the treatments that had a significant effect were limited to elicitor concentration (D) and the combination of concentration with spraying intensity (D × I) applied, but had no significant effect on the weed type (G) and spraying intensity (I) treatments. In the weed type (G) treatment, leaf area increased with

plant age, and the highest average leaf area was observed in the pakisan weed type (G2), at 621.07 cm². Meanwhile, in the spray intensity (I) treatment, the highest average was found in the treatment with elicitor spray intensity of once every 3 weeks (I3), namely 600.22 cm². Furthermore, the treatments that significantly influenced leaf area measurements namely elicitor concentration and the interaction between concentration (G) and elicitor spraying frequency (D × I) are shown in Figures 2 and 3 below.

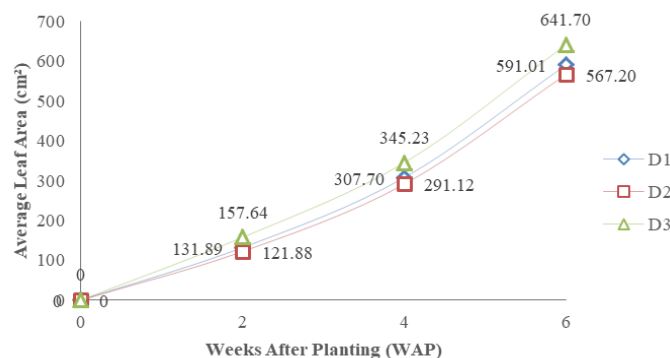


Figure 2: Effect of Biosaka Concentration on Leaf Area at 2–6 Weeks After Sowing.

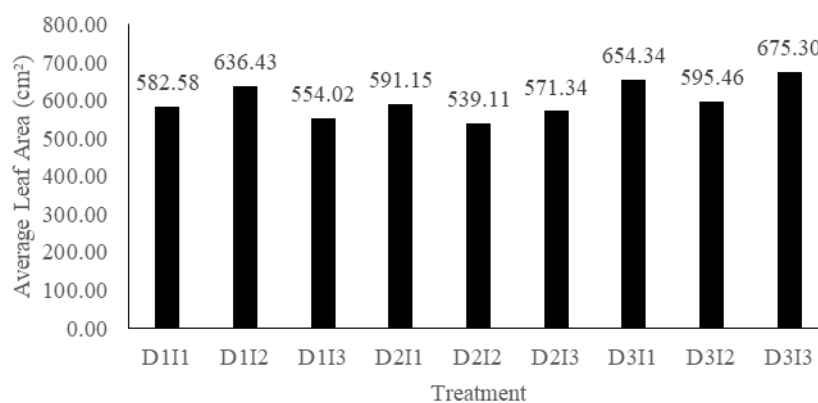


Figure 3: Factors Influencing the Combination of Biosaka Concentration and Irrigation Intensity on Leaf Area at 6 Weeks After Sowing.

The results of the study indicate that only the weekly application of Biosaka (D) and the treatment combination of Biosaka concentration and application intensity (D x I) in the sixth week affected the leaf area of dent corn (*Zea mays* L.). Table 2 shows that, for Biosaka concentration (D) treatments, the lowest average leaf area was observed at a Biosaka concentration of 40 ml/16 L of water (D2), which was 567.20 cm², while the highest was observed at a Biosaka concentration of 60 ml/16 L of water, which was 641.70 cm². Furthermore, in the treatment combinations, the lowest average leaf area was observed in the treatment with 40 ml of Biosaka per 16 L of water applied once every 2 weeks (D2I2), which was 539.11 cm², while the highest was observed in the treatment with 60 ml of Biosaka per 16 L of water applied once every 3 weeks (D3I3), which was 675.30 cm². Thus, these results indicate that as the concentration administered increases, leaf area also increases.

This occurs because, at this concentration, the elicitor can provide bioactive compounds that act as elicitors and enhance physiological plant activities, such as leaf cell division and elongation. This is achieved by indirectly influencing growth hormones such as cytokinins and auxins. Less frequent application intervals allow plants sufficient time to respond to the stimulus without experiencing stress from overstimulation, thereby maintaining a balance between growth and defense processes. These conditions allow energy allocation to be focused on vegetative tissue formation, such as leaf expansion, rather than defense mechanisms. Additionally, leaf area is associated with increased photosynthetic capacity due to a larger light-capturing surface area. This supports overall plant growth.

Therefore, the combination of a 60-ml dose and a three-week spraying interval is considered the most effective method for enhancing the plant's physiological response to the use of the biosaka elicitor, particularly for increasing leaf width (Hossain *et al.*, 2023; Naseem *et al.*, 2015; Pereira *et al.*, 2021).

In contrast to Ansar *et al.* (2023), who reported that biosaka elicitor compounds derived from natural sources are believed to enhance plant growth because biosaka containing these elicitors reduces pest and disease attacks, and the plant growth regulators (PGRs) in biosaka are believed to promote the growth of roots, stems, leaves, and fruits. Furthermore, according to Ramakrishna *et al.* (2020) and Ansar *et al.* (2023), although Biosaka elicitors have low nutrient content, they contain compounds essential for plant growth and development, such as auxins, gibberellins, and cytokinins (growth stimulants), as well as beneficial microorganisms (Appendix 16).

3.3. Flowering Period (Days) and Cob Yield per Plot (kg)

The results of the analysis of variance presented in Appendices 12, 13, 14, and 15 indicate that the weed type treatment (G) for the flowering age observation and the combination of concentration, weed type, and application intensity of Biosaka (D x G x I) had a significant effect on the yield per plot of grain maize (*Zea mays* L.). However, there was no significant effect of the spray intensity (I) and elicitor concentration (D) treatments on all observations, such as flowering age and yield per plot. These results are shown in Table 3 below.

Table 3: Average Flowering Age and Yield per Plot for Grain Maize (*Zea mays* L.)

Treatment	Observation	
	Flowering Period (Days)	Yield per Plot (kg)
Types of Weeds (G)	-----	
G0 (Control)	55.4 a	1.25
G1 (<i>Ageratum conyzoides</i>)	56.3 a	1.14

G2 (<i>Diplazium esculentum</i>)	67.7 b	1.54
G3 (<i>A. conyzoides</i> + <i>D. esculentum</i>)	56.1 a	1.26
Spraying Intensity (I)		
I1 (Every week)	59.1	1.28
I2 (2 Once a week)	61.3	1.40
I3 (3 Once a week)	56.3	1.21
Elisistor Concentration (D)		
D1 (20 ml/16 L water)	62.1	1.38
D2 (40 ml/16 L water)	60.1	1.21
D3 (60 ml/16 L water)	54.4	1.30
Concentration × Weed Type × Intensity		
D1G0I1 (20 ml + Weed-Free + Every Week)	54.0	1.36 ab
D1G0I2 (20 ml + Weed-Free + 2 Once a Week)	53.0	1.42 ab
D1G0I3 (20 ml + Weed-Free + 3 Once a Week)	54.7	1.32 ab
D1G1I1 (20 ml + <i>A. conyzoides</i> + Every Week)	61.0	0.75 a
D1G1I2 (20 ml + <i>A. conyzoides</i> + 2 Once a Week)	52.3	1.51 ab
D1G1I3 (20 ml + <i>A. conyzoides</i> + 3 Once a Week)	58.7	0.94 a
D1G2I1 (20 ml + <i>D. esculentum</i> + Every Week)	84.0	2.73 b
D1G2I2 (20 ml + <i>D. esculentum</i> + 2 Once a Week)	95.0	1.82 ab
D1G2I3 (20 ml + <i>D. esculentum</i> + 3 Once a Week)	60.0	0.99 a
D1G3I1 (20 ml + Mixed + Every Week)	54.7	1.56 ab
D1G3I2 (20 ml + Mixed + 2 Once a Week)	57.7	1.12 ab
D1G3I3 (20 ml + Mixed + 3 Once a Week)	60.0	1.09 ab
D2G0I1 (40 ml + Weed-Free + Every Week)	59.0	0.94 a
D2G0I2 (40 ml + Weed-Free + 2 Once a Week)	59.0	0.95 a
D2G0I3 (40 ml + Weed-Free + 4 Once a Week)	59.3	1.22 ab
D2G1I1 (40 ml + <i>A. conyzoides</i> + Every Week)	52.7	1.44 ab
D2G1I2 (40 ml + <i>A. conyzoides</i> + 2 Once a Week)	57.3	1.05 ab
D2G1I3 (40 ml + <i>A. conyzoides</i> + 4 Once a Week)	56.0	1.27 ab
D2G2I1 (40 ml + <i>D. esculentum</i> + Every Week)	61.7	0.73 a
D2G2I2 (40 ml + <i>D. esculentum</i> + 2 Once a Week)	88.3	2.48 b
D2G2I3 (40 ml + <i>D. esculentum</i> + 3 Once a Week)	54.3	1.24 ab
D2G3I1 (40 ml + Mixed + Every Week)	63.7	0.83 a
D2G3I2 (40 ml + Mixed + 2 Once a Week)	57.3	0.97 a
D2G3I3 (40 ml + Mixed + 4 Once a Week)	53.0	1.37 ab
D3G0I1 (60 ml + Weed-Free + Every Week)	54.3	1.11 ab
D3G0I2 (60 ml + Weed-Free + 2 Once a Week)	50.7	1.80 ab
D3G0I3 (60 ml + Weed-Free + 4 Once a Week)	54.7	1.10 ab
D3G1I1 (60 ml + <i>A. conyzoides</i> + Every Week)	52.7	1.42 ab
D3G1I2 (60 ml + <i>A. conyzoides</i> + 2 Once a Week)	57.0	1.04 ab
D3G1I3 (60 ml + <i>A. conyzoides</i> + 4 Once a Week)	59.0	0.87 ab
D3G2I1 (60 ml + Pakisan + Every Week)	60.7	0.92 ab
D3G2I2 (60 ml + Pakisan + 2 Once a Week)	53.0	1.41 ab
D3G2I3 (60 ml + Pakisan + 4 Once a Week)	52.7	1.54 ab
D3G3I1 (60 ml + Campuran + Every Week)	50.7	1.61 ab
D3G3I2 (60 ml + Campuran + 2 Once a Week)	55.0	1.25 ab
D3G3I3 (60 ml + Campuran + 4 Once a Week)	52.7	1.53 ab

Note: Numbers followed by different letters in the same column differ significantly at the 0.05 BNT level.

Based on Table 6 above, it is evident that weed type had a significant effect only on the flowering age and the emergence of flowers (days to flowering) in corn; the longest flowering period was observed in the pakisan weed treatment (G2), at 67.7 days. However, this is still within the standard, considering the high number of rainy days during the vegetative and generative phases (Appendix 19); the description (Appendix 3) indicates that the harvest age for this corn variety is 105 days.

Furthermore, regarding the observations of cob diameter and yield per plot, there was no significant effect, although differences were observed across treatments. As observed in the yield per plot analysis, the highest average cob diameter was found in the Pakisan weed treatment, at 17.49 cm. Similarly, the highest average yield per plot was also observed in the Pakisan weed treatment (G2), at 1.54 kg/plot, which converts to 3.85 tons/ha. These research results align with the findings of

Ansar *et al.* (2023), who noted that the quality of Biosaka is highly dependent on the quality of the compounds contained in the grasses and leaves used as raw materials for Biosaka production, as well as the extraction process employed. As shown in Table 9, as the flowering period increases, cob diameter becomes larger and yield increases.

Spraying frequency did not have a significant effect on all observations; however, each treatment had different average yields. Regarding flowering time, the fastest was observed with the 3-weekly elicitor spraying intensity (I3) at 56.3 days, and the longest was with the 2-weekly spraying intensity (I2) at 61.31 days. Regarding cob diameter, the highest average was 17.34 cm (I3) and the lowest was 17.11 cm (I1). For yield per plot, the highest average was observed at the elicitor spraying frequency of once every 2 weeks (I2), at 1.40 kg/plot, which converts to 3.50 tons/ha. Regarding the applied concentration, the highest average yield was observed at a concentration of 20 ml per 16 L of water (D1), which was 1.38 kg/plot, resulting in a converted yield of 3.46 tons/ha of shelled corn.

Furthermore, the interaction among the three treatments namely, the concentration of the herbicide, the type of

weed, and the spraying frequency (D × G × I)—had a significant effect on yield per plot. The highest yield was observed in the treatment using the Babadotan herbicide and a spraying frequency of once a week (D1G2I1), which was 2.73 kg/plot, converted to 6.84 tons/ha. This result has reached >50% of the total production potential described in the Appendix (Appendix 3). According to Ramli *et al.* (2024), the Biosaka elicitor made from Babadotan and Pakisan weeds has low levels of organic carbon, nitrogen, phosphorus, and potassium; however, the results of an analysis conducted by Ramakrishna *et al.* (2020) indicate that the Biosaka elicitor derived from Babadotan and Pakisan weeds contains phytochemical compounds such as alkaloids, saponins, flavonoids, tannins, essential oils, and polyphenols in Babadotan. Meanwhile, Pakisan contains relatively high levels of alkaloids, flavonoids, tannins, terpenoids, steroids, saponins, and phenolics. Furthermore, according to Ansar *et al.* (2023), the Biosaka elicitor contains plant hormones namely auxins, gibberellins, and cytokinins (growth stimulants) to support the growth and development of corn plants. The images of the cobs from the treatments yielding the highest and lowest yields can be seen in Figure 4 below.



Figure 4. a) Ears in the D2G2I1 treatment; and b) Ears in the D1G2I1 treatment.

Figure 4 above shows that the cobs in the treatment group receiving 40 ml of Biosaka elicitor + Pakisan + weekly application (D2G2I1) shown in Figure 5a, which had the lowest yield exhibited irregular seed arrangement and pale yellow seed color, and a smaller size compared to the cobs in the treatment with 20 ml of elicitors + Pakisan + Weekly (D1G2I1) Figure 5b which have a large size, a tighter and more regular seed arrangement, and a glossy yellow-orange seed color, indicating that these cobs developed well and produced high-quality seeds with high yield. This suggests that elicitor concentrations >20 ml can affect seed growth and development, as high concentrations of elicitors can activate plant defense pathways. This enhances stress tolerance but often leads to a physiological trade-off, in which some energy is redirected toward the production of secondary metabolites and protective responses rather

than toward yield production (Walters *et al.*, 2005). In addition, rainfall also influenced these results, as shown in Appendix 19, which indicates that rainfall in North Sumatra particularly in the Medan area continued to increase as the generative phase began, ranging from 110 mm to 188 mm per month. While this represents moderate rainfall levels, rainy days were quite frequent; consequently, during the generative phase, this affected the pollination process and seed formation. The corn fruit ripening phase requires sufficient light intensity; however, the relatively frequent rainfall in the Medan region affects cob or corn fruit formation. This is especially true when the treatment application is washed away by heavy rain, which consequently affects the yield.

4. CONCLUSION

The application of an elicitor made from pakisan weeds (G2) significantly resulted in the highest yield, namely 1.54 kg/plot and 3.85 tons/ha. Meanwhile, the elicitor at a concentration of 60 ml/16 L of water significantly showed the best response in vegetative growth, particularly in terms of the number of leaves (10.15 leaves) and leaf area (641.70 cm²).

Author contribution

Diapari Siregar and Syamsafitri designed this study, while Deni Syahputra conducted it.

Competing interests

We hereby declare that there are no conflicts of interest among the authors.

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