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Respon pertumbuhan dan hasil tanaman padi varietas IR 64, Ciherang, Inpari 32 terhadap aplikasi biosaka

Responses of rice growth and yield of varieties IR 64, Ciherang, Inpari 32 to biosaka application

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Abstrak. *Djauhari R, Novalina. 2024. Respon pertumbuhan dan hasil tanaman padi varietas IR 64, Ciherang, Inpari 32 terhadap aplikasi biosaka. Pros Sem Nas Masy Biodiv Indon 10: 151-157.* Upaya intensifikasi untuk meningkatkan produktivitas dan produksi padi terus dilakukan, salah satunya adalah melalui penggunaan biosaka. Penggunaan biosaka dilaporkan mempunyai banyak manfaat bagi tanaman. Namun masih sedikit laporan tentang hasil pengujian empiris terkait penggunaan biosaka, termasuk respon varietas padi yang berbeda terhadap aplikasi biosaka. Penelitian ini bertujuan untuk mengetahui pengaruh aplikasi biosaka terhadap pertumbuhan dan hasil beberapa varietas padi sawah. Penelitian percobaan dilakukan di rumah kaca Fakultas Pertanian Universitas Sumatera Utara pada bulan Oktober 2023 hingga Maret 2024, menggunakan Rancangan Acak Kelompok Faktorial yang terdiri dari dua faktor perlakuan dan tiga ulangan. Faktor pertama yaitu varietas padi (IR 64, Ciherang, Inpari 32) dan faktor kedua yaitu aplikasi biosaka (kontrol, perendaman benih, penyemprotan pada tanaman). Variabel pengamatan meliputi tinggi tanaman, jumlah anakan, jumlah anakan produktif, panjang malai, bobot malai, bobot 100 butir, persentase bobot gabah bernas, dan hasil gabah bernas. Data dianalisa menggunakan ANOVA dan uji Duncan pada α 5%. Hasil penelitian menunjukkan bahwa aplikasi biosaka mempunyai pengaruh nyata terhadap bobot 100 butir dan persentase bobot gabah bernas. Bobot 100 butir dan persentase bobot gabah bernas pada perlakuan biosaka lebih tinggi dibandingkan kontrol. Varietas IR 64, ciherang dan Inpari 32 mempunyai respon yang relatif sama terhadap aplikasi biosaka pada beberapa variabel pengamatan, dan hasil terbaik terdapat pada varietas Ciherang.

Kata kunci: Biosaka, hasil, padi, pertumbuhan, varietas

Abstract. *Djauhari R, Novalina. 2024. Responses of rice growth and yield of varieties IR 64, Ciherang, Inpari 32 to biosaka application. Pros Sem Nas Masy Biodiv Indon 10: 151-157.* Intensification efforts to increase the rice productivity and production continue to be carried out, one of which is through the use of biosaka. The use of biosaka was reported to have many benefits for plants. However, there are still few reports of empirical test results related to the use of biosaka, including the response of different rice varieties to biosaka application. This research aimed to determine the effect of biosaka application on the growth and yield of some lowland rice varieties. The experiment was conducted according to a randomized block design with a 3x3 factorial arrangement and three replication in a greenhouse (Faperta USU) from October 2023 - March 2024. The first factor was rice variety (IR 64, Ciherang, Inpari 32) and the second factor was Biosaka (control, seed soaking, plant spraying). The observation variables included plant height, number of tillers, number of productive tillers, panicle length, panicle weight, 100 grains weight, percentage of filled grain weight, and grain yield. Data were analyzed using ANOVA and Duncan's test at α 5%. The research results showed that biosaka application had a significant effect on 100 grains weight and percentage of filled grain weight. The 100 grains weight and the percentage of filled grain weight in the biosaka treatment were higher than control. The varieties IR 64, Ciherang and Inpari 32 had relatively the same response to the biosaka application on several observation variables, and the best results were found in the Ciherang variety.

Keywords: Biosaka, growth, rice, varieties, yield

INTRODUCTION

Rice is the most important food crop in Indonesia because it is the main source of staple food for the majority of Indonesian people. Indonesia's population continues to increase from year to year, causing the need for rice availability to also continue to increase. Central Bureau of Statistics (2022) reported that the rice harvest area in 2021 reached 10.41 million hectares, rice production was 54.42 million tons of dry grain. If converted into rice, rice production in 2021 reached around 31.36 million tons. The harvested area and rice production in 2021 decreased compared to the harvested area and rice production in 2020.

Intensification efforts to increase productivity and rice production continue to be carried out, one of which is through the use of biosaka. Biosaka is the result of the discovery of an agricultural practitioner, and has been reported to have many benefits for plants, including rice. However, there are still few reports of empirical test results related to the use of biosaka, including the response of different rice varieties to the application of biosaka. Biosaka comes from two syllables, namely *bio* which means life and *saka* which means *Selamatkan Alam Kembali ke Alam* (Save Nature Back to Nature) (Ansar et al. 2023). So biosaka literally means active ingredients that come from living things, in this case is plants, in order to save nature by returning to nature (using materials that come from nature) (Napitupulu et al. 2023). The use of biosaka in plant cultivation is in harmony with nature and can support organic farming which prioritizes inputs derived from natural materials.

Biosaka is made from a solution of plants or grass which can protect plants from disease and pests. Several types of plants that are commonly used as raw materials for making biosaka include *Ageratum conyzoides*, *Elephantopus mollis*, *Hippobroma longiflora*, *Cleome rutidosperma*, *Euphorbia hirta*, *Phyllanthus niruri*, *Acalypha australis*, *Erigeron sumatrensis*, *Baccharis balsamifera*, *Eupatorium denticulatum*, and others (Reflis et al. 2023).

Biosaka is a renewable technology system in the field of organic agriculture. Biosaka is not a fertilizer or pesticide but an elicitor, namely a chemical compound that can trigger a better physiological and morphological response in plants, as well as provide a positive signal to the cell membranes in the roots so that become more active and productive (Napitupulu et al. 2023). According to the inventor, biosaka is mixed from at least 5 types of plants found around rice fields or fields (Rachmat 2022), and applied to plants by spraying (Ansar et al. 2023).

Elicitors can be biotic or abiotic and can increase the production of secondary metabolites with phytoalexin properties in plants. Abiotic elicitors such as salicylic acid can increase rice plant resistance to pathogens. The use of abiotic elicitors in rice plants can increase productivity and quality of production (Leiwakabessy et al. 2018).

The research results of Samota et al. (2017) show that lowland rice varieties with different characteristics, such as lowland rice that is drought-tolerant and drought-sensitive, have different responses to the application of abiotic elicitors. Lowland rice that is tolerant to drought shows better yields than that which is sensitive to drought. However, so far there is no information regarding the response of different varieties to biosaka application. This research aimed to determine the effect of biosaka application on the growth and yield of several lowland rice varieties, namely IR 64, Ciherang, Inpari 32, as well as the response of different varieties to biosaka application.

MATERIALS AND METHODS

This research was conducted in the Greenhouse of Faculty of Agriculture, Universitas Sumatera Utara from October 2023 to March 2024. The materials used in this research were lowland rice seeds consisting of 3 varieties (IR 64, Ciherang, Inpari 32), paddy soil for planting media, water, 5 types of plants for making biosaka, Urea, TSP, KCl, pesticides (Decis and Regent). The plants used in making biosaka were goatweed (*Ageratum conyzoides*), goose grass (*Eleusine indica*), hairy spurge (*Euphorbia hirta*), quebra pedra (*Phyllanthus urinaria*), asian copperleaf (*Acalypha australis*).

This research was a factorial experiment using a randomized block design consisting of two treatment factors and three replications. The Variety Factor consists of three levels, namely IR 64, Ciherang, Inpari 32; and the Biosaka factor consists of 3 levels, namely control, application of biosaka when soaking the seeds, application of biosaka by spraying it on rice plants.

Procedures

Biosaka was made from a mixture of 5 types of plants, using the shoots/leaves that were still green and healthy. The total weight of the 5 types of plants was 100 g and then the leaves were kneaded in 3 liters of water for 30 minutes. Next, it was filtered and stored in a container. The rice seeds were soaked for 24 hours in water or treated with biosaka at a concentration of 10 mL/1 L. Next, the rice seeds were sown in plastic trays containing muddy soil. Rice seedlings aged 2 weeks after sowing were planted in plastic tubs containing muddy paddy soil, two seedlings per tub. Each plastic tub was filled with 5 kg of soil and filled with water to around 5 cm above the soil surface.

The application of biosaka which was given by spraying on rice plants began when the rice plants aged 1 week after planting (WAP), with intervals every 2 weeks. The concentration used was the same as the biosaka treatment when soaking the seeds, namely 1%. Plant maintenance included watering, cleaning weeds, fertilizing and pest control. The observation variables included plant height, number of tillers, number of productive tillers, panicle length, panicle weight, grain yield, 100 grains weight, percentage of filled grain weight.

Data analysis

Data were analyzed using analysis of variance and Duncan's advanced test at α 5%.

RESULTS AND DISCUSSION

Plant height

Rice plant height was observed every week from 1 WAP to 10 WAP. The result of the analysis of variance showed that the variety factor had a significant effect on rice plant height (significance <0.05), while biosaka factor and interaction factor had no significant effect on rice plant height. The average value of rice plant height at 10 WAP is presented in Table 1.

The rice plant height of IR 64 at 10 WAP was higher than Ciherang and Inpari 32 varieties. The average height of IR 64 rice plant was 99.30 cm, Ciherang 87.76 cm and Inpari 32 84.12 cm. The height of these plants is in sequence according to the description of rice varieties (Department of Agriculture and Food Security 2013). On the other hand, the height of rice plants between biosaka treatments was not significantly different and had relatively the same average value, namely 89.14 cm at P0 (control), 91.66 cm at P1 (biosaka treatment during seed soaking) and

90.37 cm on P2 (biosaka treatment with spraying at rice plant).

Although the rice plant height between treatment combinations was not significantly different, but there were differences in response patterns between varieties. Average value of plant height in Ciherang Variety at P1 (biosaka treatment when soaking the seeds) was higher compared to P0 (control) and P2 (biosaka treated with spraying). Meanwhile, in Inpari 32 variety at P2 was higher than P0 and P1. A recapitulation of the average value of rice plant height in each treatment combination at 1-10 WAP is presented in graphical form, at Figure 1.

The height of rice plants at 1-4 WAP was relatively the same between treatment combinations, then at 5-10 WAP, there were differences between treatment combinations. The height of rice plants in the treatment combination P0V1 (IR64 variety at control) and P1V1 (IR64 variety treated with biosaka when soaking the seeds) was higher than in other treatment combinations. On the other hand, the lowest rice plant height was found in the combination treatment P0V3 (Inpari 32 variety at control). The research results of Adiwijaya et al. (2023) which used 3 biosaka formulations applied to onion plants showed that the application of biosaka (by spraying) could increase plant height, number of leaves and bulb weight of onion plants.

Number of tillers and number of productive tillers

The number of tillers began to be observed at 3 WAP, and the number of productive tillers began to be observed at 9 WAP to 13 WAP. The results of the analysis of variance showed that the biosaka treatment, varieties and interactions had no significant effect on the number of tillers. The variety factor had a significant effect on the number of productive tillers at 10 WAP. The average values for the number of tillers and the number of productive tillers at 10 and 13 WAP are presented in Table 2.

Table 2 shows that the average value of the number of rice tillers is not significantly different between varieties and between biosaka treatments. However, the average value of the number of tillers in the P1 treatment (biosaka application when soaking the seeds) was higher compared to P0 (control) and P2 (biosaka treatment by spraying). The data in Table 2 also shows that the three varieties show the same response pattern to biosaka application. The three varieties that were treated with biosaka when soaking the seeds had a higher number of tillers compared to the control and biosaka treated by spraying.

Table 1. Rice plant height at 10 weeks after planting (WAP)

Variety	Biosaka application			Average
	P0	P1	P2	
V1 (IR 64)	100.50	99.76	97.60	99.30 b
V2 (Ciherang)	84.81	92.35	86.11	87.76 a
V3 (Inpari 32)	82.11	82.86	87.40	84.12 a
Average	89.14	91.66	90.37	

Note: P0: Control, P1: Seed soaking, P2: Spraying. Numbers followed by the same letter in the same column are not significantly different based on the Duncan Test at the α level of 5%

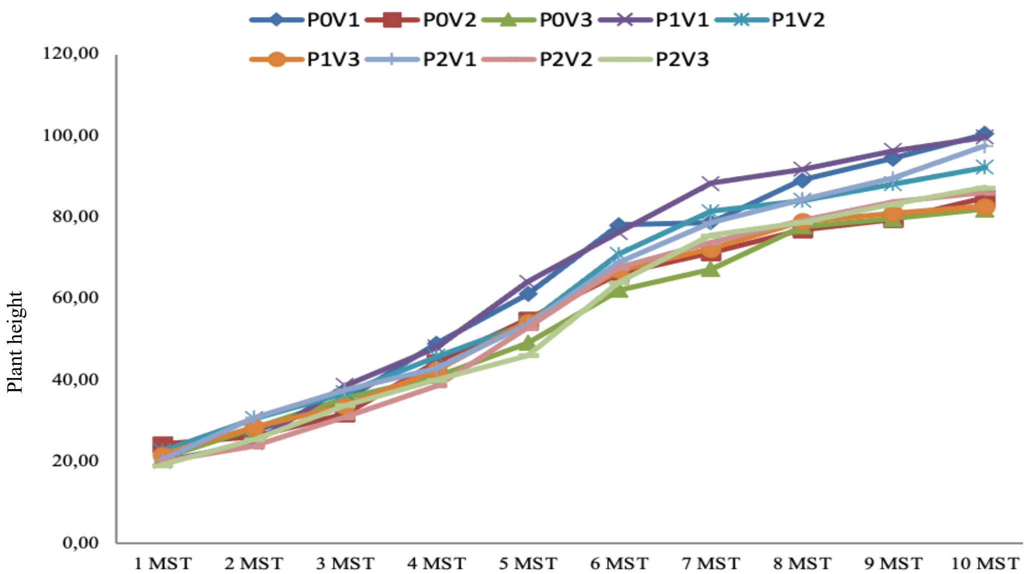

Figure 1. Rice plant height (cm) at 1-10 weeks after planting

There were significant differences in the number of productive tillers at 10 WAP between varieties. The number of productive tillers in the IR 64 variety is higher than in other varieties. This indicates that the panicles of the 1R64 variety emerge more quickly than those of Inpari 32 and Ciherang. The number of productive tillers at 10 and 13 WAP was not significantly different between biosaka treatments. However, the average value of the number of productive tillers in the P1 treatment (biosaka application when soaking the seeds) was higher compared P0 (control) and P2 (biosaka treatment by spraying). The Ciherang and Inpari 32 varieties had a similar response pattern to biosaka application in terms of the number of productive tillers, where the P1 treatment had a higher number of productive tillers compared to the control (P0) and biosaka by spraying (P2). A recapitulation of the number of productive tillers in each treatment combination at 9-13 WAP is presented in Figure 2.

Based on Figure 2, it can be seen that the treatment combination P1V2 (Ciherang variety treated with biosaka when soaking the seeds) had the highest number of productive tillers compared to other combinations, followed by P1V3 (Ciherang variety treated with biosaka when soaking the seeds). On the other hand, P2V1 (IR64 variety sprayed with biosaka) had the lowest average compared to other treatments.

Table 2. Number of tillers and number of productive tillers at 10 and 13 WAP

Variable	Variety	Biosaka application			Average
		P0 (Control)	P1 (Seed soaking)	P2 (Spraying)	
Number of tillers at 10 WAP	V1 (IR 64)	7,84	7,67	5,67	7,06
	V2 (Ciherang)	6,00	8,50	7,00	7,17
	V3 (Inpari 32)	8,84	8,67	6,84	8,17
	Average	7,56	8,28	6,50	
Number of tillers at 13 WAP	V1 (IR 64)	8,33	8,67	6,5	7,83
	V2 (Ciherang)	6,50	8,17	7,33	7,33
	V3 (Inpari 32)	8,17	8,34	7,17	7,89
	Average	7,67	8,39	7,00	
Number of productive tillers at 10 WAP	V1 (IR 64)	3,33	3,67	2,50	3,16 b
	V2 (Ciherang)	0,50	0,83	0,17	0,50 a
	V3 (Inpari 32)	1,17	2,17	0,67	1,33 a
	Average	1,67	2,22	1,11	
Number of productive tillers at 13 WAP	V1 (IR 64)	5,17	5,00	4,83	5,00
	V2 (Ciherang)	5,00	6,83	5,83	5,88
	V3 (Inpari 32)	5,67	6,67	5,67	6,00
	Average	5,28	6,17	5,44	

Note: Numbers followed by the same letter in the same column is not significantly different based on the Duncan Test at the α level of 5%

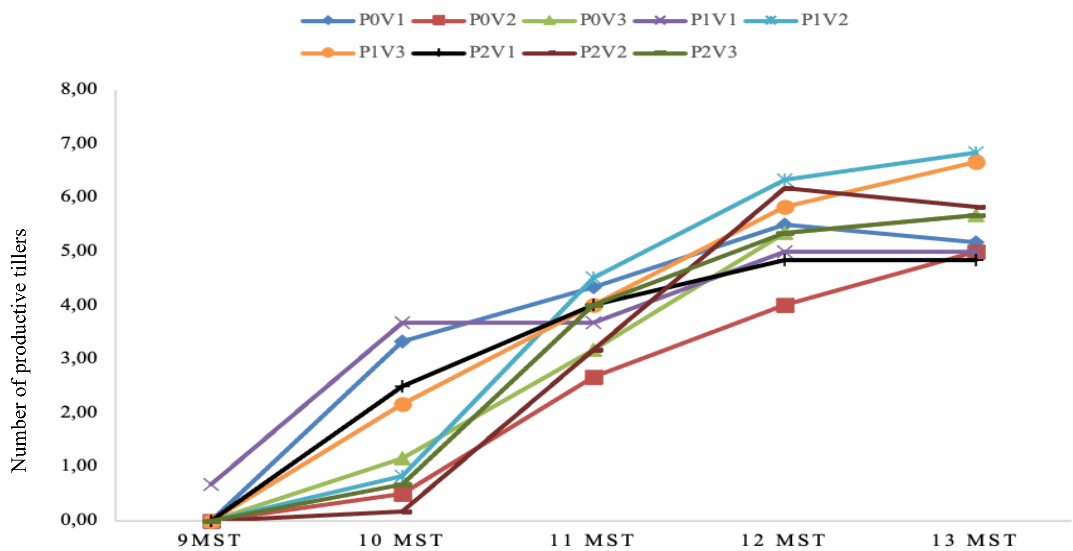

Figure 2. Number of productive tillers at 9-13 WAP

The results of this research indicate that biosaka application when soaking the seeds can increase the number of tillers and the number of productive tillers of lowland rice plants. This is possibly related to the activation of various genes related to the growth and development of rice plants as well as the efficiency of absorption and use of nutrients, especially N, by plants. Saghai et al. (2023) reported that treating wheat seeds with the elicitors methyl jasmonate and methyl salicylate has the potential to improve the efficiency of N use in soil by suppressing the population of ammonia oxiders and increasing N uptake by plants.

Number of panicles, panicle length and panicle weight

Data on the number of panicles was calculated from the harvested panicles of each clump, while the data on panicle length and panicle weight were the average values from the measurements of all the panicles harvested in each clump. The results of analysis of variance showed that the biosaka treatment, variety and interaction factors did not have a significant effect on the number of panicles, but the variety factor had a significant effect on panicle length and panicle weight. The average number of panicles, panicle length and panicle weight are presented in Table 3.

The data in Table 3 shows that the IR 64 and Ciherang varieties have longer panicles than Inpari 32. This is in accordance with the statement by Arinta and Lubis (2018) that panicle length is influenced by the cultivar or plant variety. The Ciherang variety had the highest panicle weight (1.78 g), significantly different from the IR 64 variety (1.21 g) but not significantly different from the Inpari 32 variety (1.62 g). This result shows that panicle length does not always correlate with panicle weight. This is due to the varying shape of the panicle arrangement and the quality of the grain on each panicle.

The number of panicles, panicle length and panicle weight were not significantly different between biosaka treatments. However, the biosaka treatment with soaking seeds had a higher average number of panicles compared to the control and the biosaka treatment by spraying. The biosaka treatment by spraying had a higher average value of panicle length and panicle weight compared to the control and biosaka treatment when the seeds were soaked.

The data in Table 3 shows that the three varieties have the same response pattern to the application of biosaka in terms of the number of panicles, where the average value of the number of panicles in the biosaka treatment with soaking seeds was higher compared to the control and the biosaka treatment with spraying. The varieties IR 64, Ciherang and Inpari 32 had different response patterns to biosaka application on the panicle length and panicle weight variables. The IR 64 variety had panicles that were longer and heavier in the control compared to the biosaka treatment but were not significantly different. The Ciherang variety had longer and heavier panicles in the biosaka treatment with spraying compared to the control and biosaka treatment when the seeds were soaked. Meanwhile, the Inpari 32 variety had longer panicles in the biosaka treatment with spraying, and heavier panicles in the control.

Rice yield

The results of the analysis of variance showed that the variety factor had a significant effect on grain yield per plant, 100 grains weight, and percentage of filled grain weight. Meanwhile, the biosaka factor had a significant effect on 100 grains weight, and percentage of filled grain weight. The average value of rice yield per plant, 100 grains weight, and percentage of filled grain weight are presented in Table 4.

The Ciherang and Inpari 32 varieties had a higher rice yield per plant than IR 64. The Ciherang variety had the highest 100 grain weight (2.11 g), significantly different from Inpari 32 but not significantly different from IR 64. The Ciherang variety had the highest percentage of rice grain weight (88.24%), significantly different from IR 64 (74.45%) but not significantly different from Inpari 32 (81.47%).

Table 3. The number of panicles, panicle lenght, panicle weight

Variable	Variety	Biosaka application			Average
		P0 (Control)	P1 (Seed soaking)	P2 (Spraying)	
Number of panicle	V1 (IR 64)	8,00	9,00	6,50	7,83
	V2 (Ciherang)	5,67	7,50	6,17	6,44
	V3 (Inpari 32)	6,83	10,00	7,00	8,00
	Average	6,83	8,83	6,56	
Panicle lenght (cm)	V1 (IR 64)	22,33	21,36	21,87	21,85 b
	V2 (Ciherang)	20,94	20,92	21,69	21,18 b
	V3 (Inpari 32)	19,06	17,55	19,75	18,79 a
	Average	20,78	19,94	21,10	
Panicle weight (g)	V1 (IR 64)	1,38	0,99	1,25	1,21 a
	V2 (Ciherang)	1,60	1,66	2,07	1,78 b
	V3 (Inpari 32)	1,86	1,30	1,69	1,62 ab
	Average	1,61	1,31	1,67	

Note: Numbers followed by the same letter in the same column are not significantly different based on the Duncan Test at the α level of 5%

Table 4. Rice yield per plant, 100 grains weight, and percentage of filled grain weight

Variable	Variety	Biosaka application			Average
		P0 (control)	P1 (Seed soaking)	P2 (Spraying)	
Rice yield per plant (g)	V1 (IR 64)	5,51	5,03	5,29	5,28 a
	V2 (Ciherang)	6,53	9,44	10,02	8,66 b
	V3 (Inpari 32)	7,91	8,65	8,33	8,30 b
	Average	6,64	7,71	7,88	
100 grains weight (g)	V1 (IR 64)	1,78	2,10	2,24	2,04 ab
	V2 (Ciherang)	2,06	2,20	2,07	2,11 b
	V3 (Inpari 32)	1,77	1,86	2,02	1,88 a
	Average	1,87 a	2,05 ab	2,11 b	
Percentage of filled grain weight (%)	V1 (IR 64)	60,02	75,85	87,48	74,45 a
	V2 (Ciherang)	78,58	92,67	93,48	88,24 b
	V3 (Inpari 32)	78,92	79,89	85,63	81,47ab
	Average	72,51 a	82,81 b	88,87 b	

Note: Numbers followed by the same letter in the same column or the same line are not significantly different based on the Duncan Test at the α level of 5%

The biosaka treatment, whether applied when soaking the seeds or by spraying, had a higher grain weight per plant compared to the control but was not significantly different. The biosaka treatment also had a higher 100 grains weight and a higher percentage of filled grains weight compared to the control. In general, the varieties IR 64, Ciherang and Inpari 32 have the same pattern regarding biosaka application on the variable 100 grains weight and percentage of filled grains weight. These three varieties had a higher 100 grains weight and a higher percentage of filled grain weight in the biosaka treatment compared to the control.

Application of biosaka can maximize nutrient absorption optimally. Kartika et al. (2024) stated that biosaka application can help plants maximize the uptake of the element K (potassium) which is known to help plant fertilization. Plants that experience a K (potassium) nutrient deficit will result in many processes not running optimally, for example in terms of carbohydrate accumulation, decreased starch levels. Accumulation and starch content are very influential in grain filling and therefore also influence grain weight. Hulu (2023) stated that the application of biosaka by spraying rice plants 8 times could increase the weight of 1000 grains and the weight of dry grain per plot of lowland rice plants. This is because the elicitor works on plant physiology which functions as ion absorption and the photosynthesis process. Grain filling is greatly influenced by the photosynthesis process which can produce carbohydrates for the grain filling period. Biosaka may have a biostimulant effect which helps in the absorption of nutrients which can improve the quality of the harvest. According to Albrecht (2019), plant biostimulants are substances or microorganisms which, when applied to seeds, plants or the rhizosphere, stimulate natural processes to increase nutrient absorption, nutrient efficiency, tolerance to abiotic stress or crop quality and yield.

Biosaka, which is a natural elicitor in plants, is expected not only to increase production, but also to increase resistance to pests and diseases. According to Halder et al. (2019) elicitors trigger signal transduction in plants, which involves a series of molecular interactions that ultimately lead to the activation of defense-related genes. These pathways include the salicylic acid (SA) and jasmonic acid (JA) signaling pathways, which are key regulators of defense gene expression. According to Samota et al. (2017), elicitors can attach to specific receptor proteins located on plant cell membranes and are very specific in triggering the production of secondary metabolites. Moreno-Perez et al. (2020) stated that elicitors have different chemical structures and can produce different responses depending on the species used.

In conclusion, biosaka application had a significant effect on 100 grains weight and percentage of filled grain weight. The 100 grains weight and the percentage of filled grain weight in the biosaka treatment were higher than control. The varieties IR 64, Ciherang and Inpari 32 had relatively the same response to the biosaka application on several observation variables (number of tillers, number of panicles, percentage of filled grain weight), and the best results were found in the Ciherang variety.

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