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Effect of biosaka dose combine with plant growth promoting rhizobacteria on growth and yield of rice plants in Bantul Regency Indonesia

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Abstract

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The aim of this study is to see the effect of biosaka combination with plant growth promoting rhizobacteria on the growth and yield of rice plants (*Oryza sativa* L.) IPB 3S variety. This research was carried out at the self-help agricultural and rural training center "Lestari Makmur", Semampir Hamlet, Argorejo Village, Sedayu District, Bantul Regency, Yogyakarta, Indonesia. The research was carried out using a single factor, namely biosaka dose, which was arranged in a complete randomized block design consisting of 4 replications. Each replication consisted of 5 treatments, so that 20 experimental units were obtained, namely without biosaka (K0); 43 l/ha (K1); 54 l/ha (K2); 64 l/ha (K3); 86 l/ha (K4). Observation variables included: plant height; number of tillers;dry weight of prunning; number of panicles; length of panicles; percentage of grain content; weight of 1,000 grains and weight of grain per hectare. The data obtained were analyzed statistically using ANOVA source of diversity analysis, and if a real effect was obtained, a further test was carried out using the Duncan multiple range test with a level of 5%. Based on the results of the analysis, the biosaka treatment dose of 43 l/ha gave the highest plant height, but there was no noticeable difference with other growth components. Biosaka dose treatment of 64 l/ha gives the highest number of tillers, number of panicles and weight of grain per hectare.

Keywords: dose; biosaka; rhizobacteria; growth components; yield components; IPB 3S

Introduction

Rice (*Oryza sativa* L.) is a staple crop, needed by the majority of Indonesian people. Rice is an annual plant that can adapt to various conditions and seasons, both the dry season and the rainy season. In the dry season, rice production can increase if irrigation water is always available. In the rainy season, even though water is abundant, rice production can decrease, because pollination is less intensive (Sudrajat, 2018). For rice, growth in wetlands (irrigated rice fields), rainfall is not a limiting factor for rice plants, but in dry lands rice plants require rainfall ranging from 1,500–2,000 mm/year. Rice plants grow in the lowlands, and require an altitude of 0–650 meters above sea level with a temperature of 22–27°C, while in the highlands require an altitude of 650–1500 meters above sea level with a temperature of 19–23°C (Herawati, 2012).

Basically, rice plants can be classified into two large parts, namely the vegetative part which includes roots, stems and leaves, and the generative part, which includes panicles, which consist of grains, flowers and fruit. Morphologically, rice plants have three developmental phases, namely: (1) Vegetative phase (germination to panicle initiation); (2) Reproductive phase (panicle initiation to flowering), and (3) Ripening phase (flowering to ripening) (Sitorus, 2014).

The IPB 3S rice variety is a superior variety resulting from crossing Fatmawati and IPB 6-d-10s-1-1-l rice, which has several advantages compared to other varieties, including longer panicles and long, upright flag leaf shapes. This makes the rice grains hidden, thereby reducing the risk of pests that can damage rice production. The IPB 3S rice variety also has resistance to several diseases including tungro disease in rice, and is somewhat resistant to race 003 blast disease and phototype 111 bacterial leaf blight (Maisura et al., 2020).

In order to increase the productivity of rice plants, efforts are needed to increase the results of environmentally friendly agricultural intensification, one of which is biosaka. Biosaka is a biological agent, that can save nature with a return to nature mechanism. Biosaka comes from the word "Bio", which means life and "SAKA" is an abbreviation of "Selamatkan Alam dan Kembali ke Alam" (save nature and return to nature) (Ansar et al., 2023).

Biosaka is a renewable technology system in the development of modern organic agriculture, which was formed as a biotechnology discovered by a creative farmer from Blitar, Indonesia named Muhammad Ansar in 2006. Biosaka is a plant extract consisting of several types of grass or leaves, which are usually considered weeds (at least 5 types), which are kneaded by hand with water added without additional chemicals, so that a homogeneous solution is extracted (Suwandi et al., 2023).

Based on the use of plant extracts, biosaka has the same way of working as biostimulants. Biostimulants are compounds that can encourage growth by improving plant physiological processes. Biostimulants are natural or synthetic organic compounds, that can increase growth, improve plant physiological processes such as respiration, photosynthesis, nucleic acid synthesis and ion absorption (Abbas, 2013).

Based on several studies of the biosaka materials used, leaf or grass extracts contain many secondary metabolite compounds, such as alkaloids, flavonoids, terpenoids, steroids, saponins, tannins, phenolics and quinones. These secondary metabolite compounds can be used as biostimulants that can stimulate plant growth. The quality of biosaka as a biostimulant really depends on the compounds, contained in the grass or leaves used as biosaka material. Wild plants that grow around rice fields that are considered weeds actually contain phytochemical compounds, such as alkaloids, flavonoids, steroids, saponins, tannins, phenolics and terpenoids (Nurchayati, 2022).

Apart from plant extracts, biostimulants also come from microorganisms that can encourage plant growth and development, one of which is microorganisms originating from bamboo roots (*Bambusa vulgaris*), or commonly known as Plant Growth Promoting Rhizobacteria (PGPR). PGPR is a consortium of bacteria that are active and live in colonies in plant root areas, which play an important role in increasing plant growth, crop yields and land fertility (Raka et al., 2012). In general, one of the mechanisms by which PGPR increases plant growth is by releasing plant growth regulators, such as Indole-3-acetic acid (IAA) (Benjamins and Scheres, 2008).

PGPR has three main roles for plants, namely: (i) as a biostimulant by producing growth regulators (phytohormones); (ii) as a nutrient provider by non-symbiotically binding N_2 from the air and dissolving the bound P nutrient in the soil, and (iii) as a control agent for soil pathogens (bioprotectans) by producing various anti-pathogenic secondary metabolite compounds, such as siderophore, β-1,3-glucanase, chitinase, antibiotics and cyanide (Damanik & Suryanto, 2018). When administering PGPR, there are several things that must be considered, one of which is the dose given to plants. The higher the dose given, the greater the nutrients received by the plant. Giving excessive doses will actually result in symptoms of wilting in plants (Iswati, 2008).

Several studies regarding the use of plant extracts as biostimulants have been carried out by several researchers, including Culver et al. (2012), who explained that the application of crude extract of moringa oleifera leaves by spraying onto tomato leaves two weeks after germination, can increase tomato growth and production, increase root dry mass and tomato height. In research conducted by Aniszewski (2007), it was explained that administering lupine extract containing alkaloid compounds to plant leaves could increase by 6.4% the protein and amino acid content of Phaseolus vulgaris seeds.

Ertani et al. (2015) explained that applying grape skin extract at a dose of 50 ml/L in two sprayings (2 and 4 weeks after planting), could increase the biomass and dry weight of chili plants at the flowering stage, and fruit ripening stage compared to one spraying. Abdalla (2013) in his research also explained that spraying 2% leaf extract and 3% twig extract of the *Moringa oleifera* plant with two sprays (7 and 4 days after planting), significantly increased the height, wet weight and dry weight of arugula (*Eruca sativa*) plants.

Ummah et al. (2017) explained that administering crude extract of mangosteen fruit pericarp at a concentration of 50 mg/l significantly increased the fresh weight of rice roots with the highest average being 48.33 g. Application of *C. asiatica* at a concentration of 100 mg/l can increase the height of rice plants. By administering crude extracts of mangosteen fruit, the plants showed growth in height from two to three weeks after planting.

Saban et al. (2018) explained that the application of liquid biostimulants can have a real influence on mustard plant height, plant fresh weight, and plant dry weight, while solid biostimulants can have a very real influence on all mustard plant weights, namely plant fresh weight, root fresh weight, and plant dry weight.

Qurrohman et al. (2022) explained that the application of rice husk silica extract (RHSE) 30 ml/l had a significant effect on the growth and yield of corn production. This RHSE application can increase corn plant productivity 33% higher than without using the RHSE application.

This study aims to see the effect of biosaka as a biostimulant on the growth and yield of rice plants in an environmentally friendly organic farming system. In this research, we observed the effect of various biosaka dosages in combination with PGPR on the growth and yield of IPB 3S variety rice plants in Semampir Hamlet, Argorejo Village, Sedayu District, Bantul Regency, Yogyakarta Special Region Province, Indonesia, the location of which can be seen on the map below.

Materials and Method

Study area

This research was conducted from May to August, 2023, at the self-help agricultural and rural training center "Lestari Makmur", Semampir Hamlet, Argorejo Village, Sedayu District, Bantul Regency, Yogyakarta Special Region Province, Indonesia. This place had a height of 88 meters above sea level, with regosol soil type, soil pH of 5.5–7, average temperature of 26–32°C, and rainfall of 1,654 mm/year (Ramdan et al., 2022).

Tools and materials

In this research, the tools used were a handtractor, spray tank, scales, stationery and oven. The materials used are IPB 3S variety rice seeds, mica, bamboo blades and biosaka extracts made from 6 types of leaves and grass, namely: kirinyuh (*Chromolaenaodorata* L.), sembung (*Baccharis balsamifera* L.), purslane (*Portulaca oleracea* L.), Mexican primrose-willow (*Ludwigia octovalvis* L.), gonda (*Sphenoclea zaylanica* Gaertn) and trembesi (*Samanea saman* L.), 500 g each, PGPR bamboo roots (*Bambusa vulgaris* L.) 1 l and 5 l of water and an empty bottle.

Experimental design

This research was carried out using a complete random-

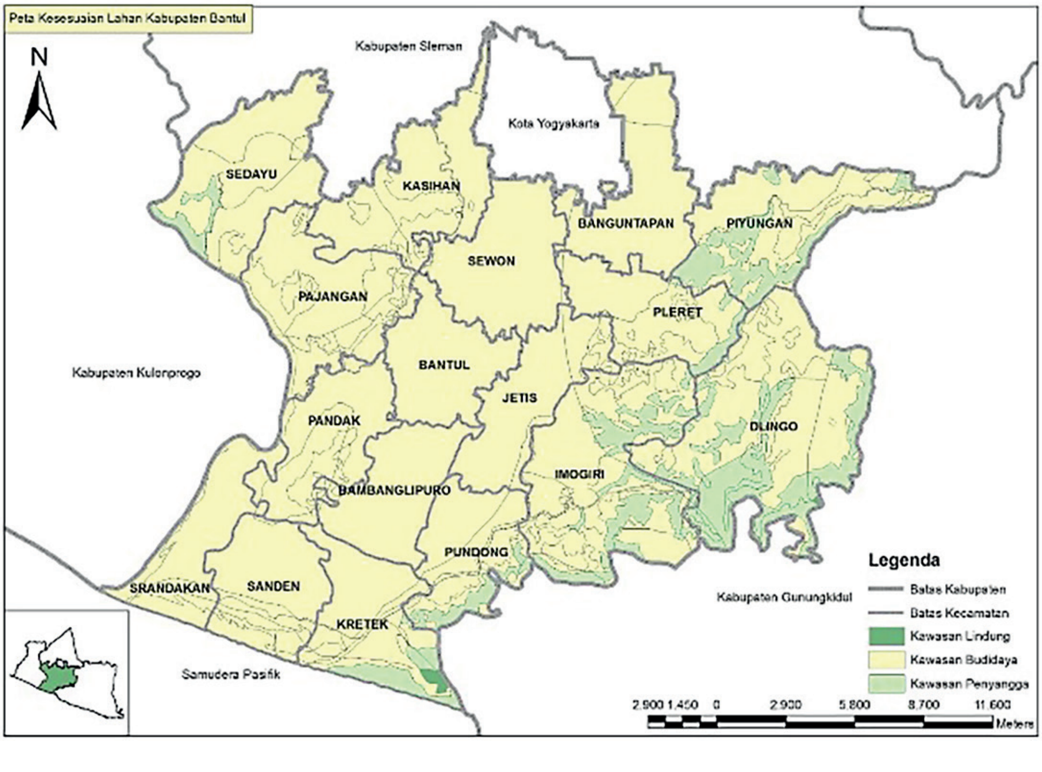

Fig. 1. Land Suitability Map of Bantul Regency
Source: https://dpmptsp.bantulkab.go.id/web/page/profil-kabupaten-bantul/

ized block design with 5 treatment levels, namely without biosaka (K0), 43 l/ha (K1), 54 l/ha (K2), 64 l/ha (K3), and 86 l/ha ha (K4). Each treatment was repeated 4 times, so that it consisted of 20 experimental units. Each experimental unit was a plot measuring 2.4 × 2.4 m, with a distance between plots of 50 cm, and a distance between replicates of 50 cm. Each plot consisted of 144 plant clusters with the number of sample plants per plot being 5 clusters, so that there were 100 sample plants tested.

Making biosaka is done by weighing the grass or leaves (kirinyuh, sembung, purslane, Mexican primrose-willow, gonda and trembesi), with a weight of 500 g each, and then put into a bucket, add 5 l of well water into the bucket and knead for 15–20 minutes until the extract comes out. After that, it is filtered using a filter and put into a bottle. The six biosaka ingredients were mixed with 1 l of bamboo roots PGPR, then filtered using a filter and put into a prepared bottle.

As preparation, the IPB 3S variety rice seeds are soaked for 24 h then cured for 48 h. The seeds that have been cured are then transferred for dry sowing with a seeding area of 2 × 1 m, and a seeding media thickness of 20 cm. The seedling media uses husk compost.

For land processing, before plowing the land is filled with water until it is stagnant, so that it is easy to plow. Land processing is carried out with a hand tractor. After plowing, measurements were taken and 20 plots measuring 2.4 × 2.4 m were made as experimental units with bamboo as a marker.

Transplanting is carried out when the seedlings are 15 days after sowing. The seeds are transplanted into previously prepared plots. The seeds are planted to a depth of 3–4 cm and the seeds planted are 3–4 plants per hill with a spacing of 20 × 20 cm.

Maintenance is carried out by irrigation once every 3 weeks. Irrigation is carried out to maintain water availability for plants, so that plant growth is optimal. Weeding is done, so that the growth of rice plants is not hampered by weeds, and reduces competition for plant nutrient absorption, so that growth and yields will be maximized.

The application of biosaka combination with PGPR bamboo roots is carried out once a week starting when the plants are 20 day after planting (DAP) until 1 week before sample harvest (93 DAP) by spraying with a dose without treatment (K0), 43 l/ha (K1), 54 l/ha (K2), 64 l/ha (K3), 86 l/ha (K4). Spraying is done in the afternoon by misting, so that the plants do not get wet.

Harvesting is carried out when the rice has reached the age of 100 DAP with the characteristics of the plant showing that it is physiologically mature, which is indicated by the rice grains turning yellow and the flag leaves turning yellow to brown. The harvesting process for sample plants is carried out by uprooting and the remaining sample plants are harvested using a sickle. Each experimental unit took 5 clumps as samples.

Observation variables

The observation variables in this study consisted of plant height, number of tillers, dry weight of prunning, number of panicles, panicle length, percentage of grain content, weight of 1000 grains, and weight of grain per hectare. Observation of rice plant height was carried out by measuring from the base of the stem to the highest growing point. Plant height observations were carried out every 7 days starting when the plants were 30 DAP until the end of the plant's vegetative period (51 DAP).

The number of tillers was counted for each clump from each sample. The number of tillers was counted every 7 days starting when the plants were 30 DAP until the end of the plant's vegetative period (51 DAP). The dry weight of prunning was observed when the plants were 100 DAP at the time of harvest. The dry weight of prunning was dried in an oven at a temperature of 105°C until the weight was constant, then the dry weight of prunning was weighed.

The number of panicles was counted for each clump of each sample. The number of panicles was counted at harvest. Panicle length was calculated by measuring the panicle from the base of the panicle to the tip of the panicle at harvest. Each panicle was counted for the total of all grain and the number of filled grains then the percentage of filled grain was calculated.

The weight of 1,000 grains was carried out by weighing 1,000 grains of filled grain per experimental unit. To determine grain productivity per hectare, the tile method was used by weighing the yield per plot x 10,000 m^2, and then dividing by the tile area. After that, weight conversion was carried out from grain yield per plot (kg) to hectare size (tons).

Data analysis

The data obtained were analyzed statistically using ANOVA (analysis of variance) source of diversity analysis. ANOVA was used to analyze a number of samples with the same amount of data in each sample group or with different amounts of data. The use of "variance" was adjusted to the basic principle of sample differences, meaning that different samples were seen from their variability. If a real effect was obtained, a further test would be carried out using the Duncan multiple range test (DMRT) with a level of 5%.

Results and Discussion

The research results in this study were in the form of observation data, which consists of eight observation variables, and was divided into two components, namely "the growth component" and "the yield component". Growth components consisted of plant height, number of tillers, and dry weight of the plant. Yield components consisted of number of panicles, panicle length, percentage of grain content, weight of 1,000 grains and weight of grain per hectare.

Growth components

In terms of growth components, average plant height, number of tillers and dry weight of prunning could be seen in Table 1.

Table 1. Average plant height at 51 DAP, number of tillers at 51 DAP and dry weight of prunning

Treatments	Plant height 51 DAP	Number of tillers 51 DAP	Dry weight of prunning
without biosaka	107.45 ab	15.35 c	43.95 a
43 l/ha	110.75 a	15.95 bc	45.53 a
54 l/ha	106.45 b	16.75 ab	45.20 a
64 l/ha	101.55 c	17.35 a	42.26 a
86 l/ha	99.8 c	15.05 c	40.81 a

In Table 2 it could be seen that the biosaka dose treatment had a significant difference to the observation variables of plant height and number of tillers, but there was no significant difference to the observation variable of dry weight of prunning. In the plant height variable, the biosaka treatment with a dose of 43 l/ha was not significantly different from that without biosaka (K0) but was significantly different from the treatment with doses of 54 l/ha, 64 l/ha and 86 l/ha. In the variable observing the number of tillers, the biosaka treatment with a dose of 64 l/ha was not significantly different from the treatment with a dose of 54 l/ha, but was significantly different from the treatment with doses of 43 l/ha, 86 l/ha and without biosaka. In the growth component the treatment dose of biosaka 43 l/ha gave the highest number for the plant height variable, while the biosaka dose of 64 l/ha gave the highest number for the variable observing the number of tillers.

The results of variance analysis showed that the treatment with various biosaka doses had a significant effect on several growth components, namely plant height and number of tillers, but did not have a significant effect on the dry weight variable of the plant. Biosaka treatment with a dose of 43 l/ha gave the highest figure for the plant height variable (110.75 cm), while biosaka treatment with a dose of 86 l/ha gave the lowest figure (99.8 cm). This is thought to be, because administering a small dose of biosaka is able to encourage plant height growth, while administering a large dose of biosaka can inhibit plant height growth.

The relationship between biosaka doses, which increases or decreases plant growth, is related to the secondary metabolite compounds contained in biosaka. Secondary metabolites can act as intermediaries in allelopathic interactions. Kamsurya (2010) stated that the lower allelopathic effect of kirinyuh extract (ratio of 1:6 and 1:9) can encourage growth, while the higher concentration (ratio of 1:3) can inhibit the growth of corn plants. In the variable number of tillers, biosaka treatment with a dose of 64 l/ha gave the highest results, but treatment with a dose of 86 l/ha reduced the number of tillers.

Secondary metabolite compounds that have a positive impact on plant growth and development are terpenoid and steroid compounds. The ingredients used in making biosaka in this study contain many terpenoid and steroid compounds. This is in line with the results of phytochemical tests carried out by several previous researchers, that the ingredients in making biosaka contain terpenoid, steroid and saponin compounds. Terpenoid and steroid compounds have a role in plant development such as cell division and stem elongation.

One of the hormones included in the terpenoid group is the gibberellin hormone (Kabera et al., 2014). Terpenoid

Table 2. Content of phytochemical compounds in biosaka making materials

No.	Plant type	Alkaloids	Flavonoids	Terpenoids	Steroids	Tannins	Saponins	Phenolics	Quinonines
1	Sembung (*Baccharis balsamifera* L.)	+	+	+	+	–	+	+	+
2	Kirinyuh (*Chromolaena odorata* L.)	+	+	+	+	+	+	–	–
3	Gonda (*Sphenoclea zaylanica* gaertn)	+	+	–	+	+	+	+	–
4	Purslane (*Portulaca oleracea* L.)	+	+	–	–	+	+	+	–
5	Mexican primrose-willow (*Ludwigia octovalvis* L.)	+	+	+	+	–	–	+	–
6	Trembesi (*Samanea saman* L.)	+	+	–	+	–	+	+	–

Description: (–): negative (do not contain), (+): contain

Source: Hajra et al. (2010); Nurjannah et al. (2013); Sinarsih et al. (2016); Fadia et al. (2020); Johannes andSjafaraenan (2023); Sukadiasa et al. (2023)

compounds found in plant tissue act as bioactivities by encouraging the action of gibberellins which can stimulate plant growth and development. According to Zi et al. (2014) terpenoid compounds can play a role in encouraging the action of gibberellins which will influence plant cell division. This cell division can encourage stem growth and increase the number of tillers. Choudhary et al. (2012) explained that steroids have an important role in plant development, including cell division, stem and root elongation, photomorphogenesis, leaf senescence, and response to stress.

Phytochemical screening tests have been carried out by several researchers on plant extracts, used as ingredients for making biosaka in this research. Several plant extracts containing secondary metabolite compounds such as: alkaloids, terpenoids, steroids, flavonoids, phenolics, tannins, saponins and quinonines can be seen in Table 2.

Apart from terpenoid and steroid compounds, the addition of PGPR can help plants to absorb the N nutrient that plants need in the growth process. The addition of PGPR can maximize the absorption of N nutrients during the vegetative phase. The addition of PGPR to biosaka can maximize the absorption of the N nutrient, thereby increasing the number of tillers. Chaturvedi (2005) stated that, the availability of N plays a role in cell division, so that it can increase the number of offspring. The number of tillers formed will influence the number of productive tillers, and will have an impact on increasing crop yields (Rahmad et al., 2022).

Yield components

In terms of yield components, the average number of panicles, panicle length, percentage of grain content, weight of 1,000 grains, and weight of grain per hectare were presented in Table 3.

Table 3 showed that in the biosaka dose treatment there was a significant difference in the observation variables of number of panicles and weight of grain per hectare, but there was no significant difference in the observation variables of panicle length, percentage of grain content and weight of 1,000 grains. In the observation variables of number of panicles andweight of grain per hectare, biosaka treatment with a dose of 64 l/ha was not significantly different from treatment with a dose of 54 l/ha, but was significantly different from treatment with doses of 43 l/ha, 86 l/ha and without biosaka. In thet yield component, the treatment dose of biosaka 64 l/ha gave the highest figures for the observation variables of number of panicles and grain production per hectare.

The results of the analysis of variance on the yield components, showed that the dose treatment had a significant effect on the observation variables of number of panicles and grain weight per hectare, but the biosaka dose treatment had no significant effect on the observation variables of panicle length, percentage of grain content, and weight of 1,000 grains. In the yield component, the treatment dose of biosaka 64 l/ha gave the highest figures for the observation variables of number of panicles and weight of grain per hectare. This is thought to be because biosaka treatment at a dose of 64 l/ha is able to stimulate an increase in the plant's physiological response so that it can increase the number of panicles and weight of grain per hectare.

The secondary metabolite content in biosaka contains terpenoid, steroid and saponin compounds, so that it can increase the physiological response of plants by increasing cell division, which leads to an increase in the number of tillers, there by increasing the number of panicles and increasing the biomass of fruit produced. This is in line with research conducted by Rahmadani (2021) on administering moringa leaf extract biostimulants, containing terpenoid compounds to Singgalang cabbage (*Brassica oleraceae* var.*capitata*), so that it can increase the number of leaves and area significantly. According to Andresen and Cedergreen (2010), triterpenoid saponins contained in tea plant (*Camellia sinensis*) seed extract can improve plant physiological responses and increase strawberry biomass by administering 1.5 g/l of crude extract.

The biosaka treatment dose of 86 l/ha gave a lower figure compared to the 64 l/ha treatment. Giving biosaka at higher doses will have a negative influence on growth components and yields. This is thought to be because the content of sec-

Table 3. Average number of panicles, panicle length, percentage of grain content, weight 1 000 grains and weight of grain per hectare

Treatments	Number of panicles	Panicle length (cm)	Percentage of grain content (%)	Weight of 1,000 grains (g)	Weight of grain per hectare (ton)
Without biosaka	12.35 c	22.75 a	89.05 a	28.25 a	4.85c
43 l/ha	12.55 bc	23.35 a	89.45 a	30 a	5.35 bc
54 l/ha	13.65 ab	23.55 a	88.85 a	29a	5.65 ab
64 l/ha	13.95 a	23.85 a	89.15 a	29a	5.85 a
86 l/ha	11.55 c	24.35 a	88.95 a	29a	5.15 c

Description: Numbers in columns followed by the same letter indicate there is no significant difference at the 5% level of DMRT ondary metabolite compounds in biosaka at higher doses will cause plant growth and development to be hampered due to the allelopathic effect, which contains flavonoid compounds, saponins and tannins, which are phenolic in nature. According to Marina and Rahayu (2016), allelochemicals in the phenol group cause obstacles to physiological functions, which result in disruption of nutrient absorption and photosynthesis, causing little photosynthesis to be produced, and reducing the wet and dry weight of plants.

The way allelochemicals work in allelopathy on plant growth and development goes through several stages. The allelopathic stage begins with the appearance of structural disturbances in the plasma membrane, modification of membrane channels, or loss of function of the ATP-ase enzyme. This disturbance will affect the absorption of ion and water concentrations, which then affect the opening of stomata and the photosynthesis process. These obstacles then lead to disruption of cell division and enlargement, which ultimately inhibits the growth and development of the target plant (Kilkoda, 2015). This is in line with research conducted by Noli and Labukti (2022), which stated that giving 100 mg/l of resam fern extract had the best effect on the number of fruit planted (28.83), but giving extract with a concentration of 150 mg/l could reduce number of fruit planted (24.00). Biostimulants will only work at appropriate concentrations. Inappropriate concentrations will not have a positive effect and can even cause negative effects on plants (Nardi et al., 2016).

Apart from the biosaka content, the addition of PGPR also plays a role in increasing the yield component. PGPR is able to meet the availability of nutrients, needed to increase the growth and yield of rice plants. Fajariyani and Sumarni (2019) stated that PGPR can be considered as a biological fertilizer (biofertilizer), which can influence the availability of sufficient nutrients that can be absorbed by plants. This can help the process of optimal growth and absorption of nutrients, which in turn can increase the growth and yield of rice plants, so that the yield of dry grain weight harvested per plot can increase.

In this study, there were several growth observation variables and yield that showed there was no real difference to the biosaka dose treatment. This is thought to be because the compounds contained in biosaka as biostimulants, have not been able to work optimally on several observed variables, so that there is no stimulation that leads to significant growth or yield. This is in line with research conducted by Noli and Labukti (2022) on giving resam fernextract to curly chilies, which had a significant effect on the observation variables of stem diameter, number of fruit per plant and chlorophyll content, but was not significantly different on the observation variables of plant height, wet weight plants, dry weight plants and fruit length. Each plant provides different effects depending on the extract source and plant variety tested (Pajrita et al., 2023).

The use of biosaka combined with PGPR at appropriate doses can increase plant growth and yield. Using excessive doses of biosaka will inhibit plant growth. Biostimulants in low concentrations can increase plant growth and development, but in high concentrations biostimulants will inhibit plant growth and development (du Jardin, 2015).

Conclusions

Biosaka is a renewable technology system in the development of modern organic agriculture, which is formed as environmentally friendly biotechnology. As a new breakthrough, biosaka acts as a biostimulant for plant growth. The application of biosaka combination with PGPR, at a dose appropriate to plant development, can increase the growth and productivity of rice plants.

Treatment with a biosaka dose of 43 l/ha was able to encourage plant height growth and treatment with a biosaka dose of 86 l/ha inhibited plant height growth. The biosaka treatment dose of 64 l/ha was able to stimulate an increase in the physiological response of rice plants, thereby increasing the number of tillers, number of panicles and weight of grain per hectare.

It is necessary to select biosaka materials that are appropriate to the type of cultivated plant, so that the effectiveness of the compounds contained in biosaka can work more optimally according to the type of plant, soil, air humidity and the surrounding environment, so that it can increase plant growth and productivity.

References

Andresen, M. & Cedergreen, N. (2010). Plant growth is stimulated by tea-seed extract: a new natural growth regulator. *Journal of the American Society for Horticultural Science*, *45*(12), 1848 – 1853.

Abbas, S. M. (2013). The influence of biostimulant on the growth and on thebiochemical composition of *Vicia faba* cv. Giza 3 beans. *Romanian Biotechnological Letters*, *18*(2), 8061 – 8068.

Abdalla, M. M. (2013). The potential of Moringa oleifera extract as a biostimulan inenhancing the growth, biochemichal and hormonal contents in rocket *(Eruca vesicaria* subsp*. sativa). International Journal of Plant Physiology and Biochemistry*, *5*(3), 42 – 49.

Aniszewski, T. (2007). Alkaloids-secret of Life: Alkaloid Chemistry, Biological Significance, Applications and Ecological Role. 1st Edition. *Elsevier,* Amsterdam.

Ansar, M., Manurung, R., Barki, H., Suwandi, Pambudy, R.,

Fahmid, I. M. & Sugiharto, U. (2023). Biosaka nuswantara elicitor: sustainable agricultural breakthrough towards the land of nuswantara land of harmony. *IPB Press*, Bogor (Id).

Benjamins, R. &Scheres, B. (2008). Auxin: the looping star in plantdevelopment. *Annual Review of Plant Biology*, *59*(1), 443 – 465.

Chaturvedi, I. (2005). Effect of nitrogen fertilizer on growth, yield and quality of hybrid rice (*Oryza sativa* L.). *Journal Central European Agriculture*, *6*(4), 6 – 68.

Choudhary, S.P., Yu, J. Q., Kazuo, K. Y. S., Shinozaki & Tran, L. S. P. (2012). Benefits of brassinosteroid crosstalk. *Trends in Plant Science*, *17*(10), 594 – 605.

Culver, M., Fanuel, T. & Chiteka, A. Z. (2012). Effect of moringa extract ongrowth and yield of tomato. *Greener Journal of Agricultural Sciences, 2*(5), 207 – 211.

Damanik, S.A. & Suryanto, A. (2018). Effectiveness of using mycorrhiza and PGPR (plant growth promoting rhizobacteria) on shallot plants (*Allium ascalonicum*) in PVC pipes in verticulture systems. *Jurnal Produksi Tanaman*, *6*(4), 635 – 641 (Id).

du Jardin, P. (2015). Plants biostimulants: definition, concept, main categories and regulations. *Scientia Horticultura*, *196*(1), 3 – 14.

Ertani, A., Sambo, P., C. Nicoletto, C., Santagata, S., Schiavon, M. & Nardi, S. (2015). The use of organic biostimulants in hot pepper plants to help low input sustainable agriculture.*Chemical and Biological Technologies in Agriculture*, *2*(1), 1 – 10.

Fadia, F., Nurlailah, N., Helmiah, T. E. & Lutpiatina, L. (2020). Effectiveness of ethanol extract of kirinyuh leaves (*Chromolaena odorata* L.) as an antibacterial against *Salmonella typhi* and *Staphylococcus aureus*. *Jurnal Riset Kefarmasian Indonesia*, *2*(3), 158 – 168 (Id).

Fajariyani, A.I. & Sumarni, T. (2019). The effect of plant growth promoting rhizobacteria (PGPR) and manure on the growth and yield of rice (*Oryza sativa* L.). *Jurnal Produksi Tanaman*, *7*(9), 1602 – 1610 (Id).

Hajra, S., Mehta, A., Pandey, P., John, J. & Mehta, P. (2010). Antibacterial property of crude ethanolic extract of *Mikania micrantha*. *Asian Journal of Experimental Biological Sciences*, *1*(1), 158 – 160.

Herawati, D.W. (2012). Rice Cultivation. *Javalite Ra*, Yogyakarta (Id).

Iswati, R. (2008). Effect of dosage of PGPR formula from bamboo roots on the growth of tomato plants (*Solanum lycopersicum* syn). *Jurnal Agroteknotropika*, *1*(1), 9 – 12 (Id).

Johannes, E & Sjafaraenan (2023). Cytotoxic and phytochemical tests of the n-hexane fraction of krokot stem and leaf extract (*Portulaca oleracea* L.). *Bioma: Jurnal Biologi Makassar*, *8*(2), 81 – 87 (Id).

Kabera, J. N., Semana, E., Mussa, A. R. & He, X. (2014). Plant secondary metabolites: biosynthesis, classification, function and pharmacological properties. *Journal of Pharmacy and Pharmacology*, *2*(1), 377 – 392.

Kamsurya, M.Y. (2010). Effect of alelophaty on krinyu leaf extract on the growth and development of corn (*Zea mays* L.) plants. *Jurnal Agrohut*, *1*(1), 25 – 30 (Id).

Kilkoda, A.K. (2015). Response of allelopathy from *Ageratum conyzoides* and *Borreria alata*weeds on growth and yield of three varieties of soybean (*Glycine max*). *Jurnal Agroteknologi*, *2*(1), 39 – 49 (Id).

Maisura, M., Jamidi, J. & Husna, A. (2020). Growth response and yield of rice plants (*Oryza sativa* L.) IPB 3S variety in several jajarlegowo systems.*Jurnal Agrium Unimal*, *17*(1), 33 – 44 (Id).

Marina, T. & Rahayu, A. Y. (2016). Growth response of corn (*Zea mays* L.) to weed extract: laboratory scale. *Jurnal Agrin*, *20*(1), 54 – 63 (Id).

Nardi, S., Pizzeghello, D., Schiavon, M. & Ertani, A. (2016). Plant biostimulants: physiological responses induced by protein hydrolyzed based products and humic substances in plant metabolism. *Scientia Agricola*, *73*(1), 18 – 23.

Noli, Z. A. & Labukti, H. V. (2022). Effect of resam fern (*Gleichenia linearis*) extract as a biostimulant on the growth and yield of curly chili (*Capsicum annum* L.) kopay cultivar. *Agro Bali: Agricultural Journal*, *5*(3), 492 – 497 (Id).

Nurchayati, N. (2022). Ethnobotany of wild plants as family medicinal plants from the perspective of the people of Umbulrejo Hamlet, Bagorejo Village, Banyuwangi Regency. *Proceedings of the National Seminar MIPA UNIBA*, *2*(1), 191 – 200 (Id).

Nurjannah, U., Yudono, P., Suyono, A. T. & Shieddiq, D. (2013). Jengkol fruit peel (*Phitecellobium jiringa*) as a bioherbicide for rice weeds. *Joglo*, *25*(2), 162 – 170 (Id).

Pajrita, A., Noli, Z. A. & Suwirmen, S. (2023). The effect of moringa leaf extract extracted with several types of solvents as a biostimulant on the growth of red spinach. *Bioscientist: Jurnal Ilmiah Biologi*, *11*(1), 531 – 542 (Id).

Qurrohman, B. F. T., Taofik, A., Ramadhani, R. & Suriadikusumah, A. (2022). Effectiveness of concentration of rice husk silica extract on growth and yield of sweet corn (*Zea mays saccharata* Strut). *Bulg. J. Agric. Sci.*, *28*(1), 61 – 68.

Rahmad, D., Nurmiaty, N., Halid, E., Ridwan, A. & Baba, B. (2022). Characterization growth and production some superior rice varieties. *Jurnal Agroplantae*, *11*(1), 37 – 45 (Id).

Rahmadani, S. (2021). Effect of kelor extract (*Moringa oleifera* L.) as a biostimulant to on the growth of kubis singgalang (*Brassica olerceae* var. *capitata* L.). Undergraduate Thesis. Department of Biology, Faculty of Mathematics and Natural Sciences, University of Andalas, Padang, Indonesia (Id).

Raka, I. G. N., Khalimi, K., Nyana, I. D. N. & Siadi, I. K. (2012). Application of the rhizobacteria *Pantoea agglomerans* to increase the growth and yield of corn (*Zea mays* L.) hybrid variety BISI-2. *Agrotrop*, *2*(1), 1 – 9 (Id).

Ramdan, M., Maryani, Y. & Pamungkas, D. H. (2022). Response of growth and yield of red rice (*Oryza nivara* L.) Inpari 24 gabusan variety to types of NPK fertilizer and concentration of nanosilica fertilizer. *Jurnal Ilmiah Agroust*, *6*(2), 72 – 83 (Id).

Saban, R., Kesaulya, H. & Nendissa, J. I. (2018). The effect of biostimulant applications on growth and yield of mustard (*Brassica juncea* L.). *Jurnal Budidaya Pertanian*, *14*(1), 41 – 46 (Id).

Sinarsih, N. K., Rita, W. S. & Puspawati, N. M. (2016). Test the effectiveness of trembesi leaf extract (*Samaneasaman* (Jacq.) Merr) as an antibacterial for *Escherichia coli* and *Staphylococcus aureus*. *Cakra Kimia (Indonesian E-Journal of Applied Chemistry)*, *4*(2), 129 – 136 (Id).

Sitorus, H. L. (2014). Response of several upland rice cultivars to ultisol to the application of aluminum with different concentrations. Undergraduate Thesis. Faculty of Agriculture, University of Bengkulu, Indonesia (Id).

Sudrajat, I. S. (2018). The Influence of socio-economic factors on the efficiency of organic rice farming in Boyolali Regency, Central Java. Dissertation. Doctoral Program in Agricultural Sciences, University of Sebelas Maret Surakarta, Indonesia (Id).

Sukadiasa, P. I. K., Wintariani, N. P. & Putra, I. G. N. A. W. W. W. (2023). Test the antibacterial effectiveness of 96% ethanol extract of gonda plants (*Sphenoclea zeylanica* Gaertn) against *Staphylococcus aureus. Jurnal Ilmiah Medicamento*, *9*(1), 61 – 69 (Id).

Suwandi, Manurung, R., Ansar, M., Sugiharto, U., Rachmat, Rachim, R., Gandhi, P. & Purnama, N. E. (2023). Biosaka elicitor, sustainable agricultural breakthrough towards the land of nuswantara land of harmony. *Co & Act Creative Hub*, Bogor (Id).

Ummah, K. K., Noli. Z. A., Bakhtiar, A. & Mansyurdin (2017). Test of certain plantcrude extracts on the growth of upland rice (*Oryza sativa* L.*). International Jourrnal of Current Research in Biosciences and Plant Biology, 4*(9), 1 – 6.

Zi, J., Mafu, S. & Peters, R. J. (2014). To gibberellins and beyond surveying the evolution of (di)terpenoid metabolism. *Annual Review of Plant Biology*, *65*(1), 259 – 286.

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