Fruitset Sains, 11 (6) (2024) pp. 463-468

Published by: IOCSCIENCE

Fruitset Sains : Jurnal Pertanian Agroteknologi

Journal homepage: www.iocscience.org/ejournal/index.php/Fruitset

EFFECT OF NPK FERTILIZER DOSES ON ANTIOXIDANT AND ANTIMICROBIAL LEVELS OF SAMBUNG NYAWA (Gynura procumbens)

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Abstract

Gynura procumbens, commonly known as sambung nyawa, holds substantial medicinal value attributed to its diverse chemical compounds, including flavonoids, unsaturated sterols, triterpenoids, polyphenols, saponins, steroids, chlorogenic, caffeic, vanillic, para-coumaric acids, hydroxy benzoic acids, and essential oils. This study investigates the impact of NPK fertilizer dosages on sambung nyawa's antioxidant levels and antimicrobial activities. The research employed a Non-Factorial Randomized Complete Block Design (RCBD) with one treatment factor - NPK fertilizer dosage (N) at four levels. Results revealed significant effects of NPK fertilizer doses on leaf and total plant weights. Higher doses notably enhanced antimicrobial activity against various bacteria strains like E. coli, B. cereus, E. aerugenes, L. innocua, and S. aureus. Additionally, the plant exhibited strong antioxidant capabilities, demonstrating an IC50 DPPH scavenging activity of 2.112 mg/ml. This investigation provides crucial insights into optimizing NPK fertilizer dosages to boost sambung nyawa's antioxidant content and antimicrobial potency. The findings hold promise for agricultural practices and the potential utilization of this plant in health and medicinal realms.

Keywords: Gynura procumbens, antioxidant levels, Antimicrobial activities.

Abstrak

Gynura procumbens, yang umumnya dikenal sebagai sambung nyawa, memiliki nilai pengobatan yang signifikan yang berasal dari beragam senyawa kimianya, termasuk flavonoid, sterol tak jenuh, triterpenoid, polifenol, saponin, steroid, asam klorogenat, asam kafeat, asam vanilat, asam para kumarat, asam hidroksi benzoat, dan minyak atsiri. Penelitian ini menyelidiki dampak dosis pupuk NPK terhadap tingkat antioksidan dan aktivitas antimikroba sambung nyawa. Penelitian ini menggunakan Rancangan Acak Kelompok Non Faktorial (RAK) dengan satu faktor perlakuan - dosis pupuk NPK (N) dalam empat level. Hasilnya menunjukkan pengaruh signifikan dari dosis pupuk NPK terhadap berat daun dan total tanaman. Dosis yang lebih tinggi secara mencolok meningkatkan aktivitas antimikroba terhadap berbagai jenis bakteri seperti *E. coli, B. cereus, E. aerugenes, L. innocua, dan S. aureus*. Selain itu, tanaman ini menunjukkan kemampuan antioksidan yang kuat, dengan aktivitas penangkapan DPPH sebesar 2.112 mg/ml. Penelitian ini memberikan wawasan penting tentang optimalisasi dosis pupuk NPK untuk meningkatkan kandungan antioksidan dan daya antimikroba sambung nyawa. Temuan ini menjanjikan untuk praktik pertanian dan potensi pemanfaatan tanaman ini dalam kesehatan dan bidang pengobatan.

Kata Kunci: sambung nyawa, tingkat antioksidan, aktivitas antimikrob.

1. INTRODUCTION

Indonesia has many biological natural resources. Biological resources are used in various ways to meet human needs, one of the biological resources that has several advantages for being used as herbal medicine is *Gynura procumbens* (Lour.) Merr. or called life-giving plants. Life-giving plants are spread throughout tropical Asia, such as Malaysia, Indonesia, China, Myanmar and Thailand. Medicinal plants from the Asteraceae family (Sumadji and Pitoyo, 2019).

The *Gynura Procumbens* plant is widely used as a raw material for herbal medicines because it contains the chemical compounds flavonoids, unsaturated sterols, triterpenoids, polyphenols, saponins, steroids, chlorogenic acid, caffeic acid, vanillic acid, paracoumaric acid, hydroxy benzoic acid and essential oils. antioxidant and antimicrobial. This compound is a raw material for making antioxidants and antibacterials. Antioxidants are important

compounds in the body to maintain health. Antioxidants can function as an antidote to free radicals which are often formed in the body due to the environment and unhealthy lifestyles, thereby stopping chain reactions and converting free radicals into a stable form. The Sambung Nyawa plant also functions to maintain immunity and the body's resistance to disease and can also be used as an alternative treatment for various diseases, such as diabetes mellitus with the effect of lowering blood sugar levels (Aprilani et al., 2019).

Succulent leaves also have anti-bacterial power against several pathogenic bacteria. The use of lucifer leaves for medicine is due to the flavonoids and essential oils they contain. The ethanol extract of sambungjiwa leaves contains alkaloids, saponins, steroids, flavonoids, tannins and terpenoids (Nur et al., 2023). The use of life-giving plants as an antibacterial is supported by the presence of compounds that act as antibacterials such as flavonoids which play a very important role in inhibiting growth and killing bacteria. Apart from that, flavonoids can inhibit swelling in infected tissue (anti-inflammatory) and can repel free radicals (antioxidants). Several species of life-giving plants are also grown as ornamental or medicinal plants, such as *Gynura aurantiaca* (purple passion) and *Gynura procumbens* (long-life spinach). However, an obstacle that is often found in the cultivation of splicing life is the low production of leaves and the anti-biotic compounds produced. This is caused by low soil fertility so proper fertilization techniques are needed for the growth of *Gynura procumbens* plants.

Plants really need fertilization, apart from providing nutrients in the soil, fertilizer also functions to maintain nutrient stability in plants. Fertilizer can also help plants grow optimally, and appropriate fertilization and the right dose can help plants grow and produce optimally. Fertilizer is an important factor that influences the growth and quality of gynura plants. For *gynura procumbens*. you can use complex mineral fertilizer containing nitrogen, phosphorus and potassium. A study by (Ahmed et al., 2021). States that the best combination of shade and nitrogen fertilizer for this plant is 30% shade with a dose of 300 kg N ha-12. This results in high biomass production and physiological responses. Application of fertilizer every two weeks during spring and summer. For both species, excessive fertilization should be avoided because it can cause leaf burn, root damage, and nutrient imbalance.

Based on the description above, researchers conducted research on the importance of obtaining doses of NPK fertilizer that can increase antioxidant and antimicrobial levels in life-giving plants.

2. METHODS

The research was carried out from September to October 2023 at the Lepas Tuai Laboratory, Industrial Crop Center Building, Malaysian Agriculture Research and Development Intitute (MARDI), Serdang, Selangor. The research was conducted using a non-factorial randomized block design (RAK) consisting of 1 treatment factor and 3 replications: NPK (N) fertilizer application factor, using 4 levels N1 : 0 g/plant, N1 : 3 g/plant, N2 : 5 g/plant, N3 : 7 g/plant. The main raw materials in this research were Sambung Nyawa leaf powder and 70% methanol. The equipment used in this research was a hot plate, 40 mesh sieve, funnel, reflux condenser, three-neck flask, blender, electric scale, filter paper thermometer, rotary evaporator, water bath, UV-Vis spectrophotometry, and glassware. The parameters observed in this study were the effect of NPK fertilizer on leaf fresh weight, total wet weight, antioxidants and antimicrobials.

2.1 Research Implementation

2.1.1 Making gynura procumbens powder

Life-giving plants are planted vertically without soil in the MARDI Serdang fields, Selangor, harvested at the age of 60 days. Upon arrival at the laboratory, they were washed with running tap water to remove surface pollutants and cut into small pieces. Then it was dried in a hot air oven at 50°C for 48 hours. Then the sample was sieved using a 40 mesh sieve to obtain sumbu leaf powder. Once dry, the samples were ground into a fine powder (moisture content 8-10% dry) and stored in an airtight container before extraction. Samples were extracted with 70% methanol (1:10) with sonication for 1 hour. For 3 days macerated with occasional stirring. On the third day, filtering was carried out using Wattmanno filter paper. 1 and the dregs are remacerated 3 times. The filter results are collected and concentrated using a rotary evaporator to obtain a concentrated ethanol extract. The ethanol extract obtained is then collected and the liquid is evaporated using a water bath at a temperature of 95˚C to obtain a thick ethanol extract so that the extract is ethanol free (Auliafendri and Rila, 2023).

2.1.2 Antioxidant Test Gynura procumbens leaves

Preparation of ascorbic acid as a positive standard Dissolve 10.761 mg of ascorbic acid in 100 ml of 100% methanol. Perform serial dilatations to obtain a stock concentration of 0.1761 mg/ml. Prepare the concentration range as DPPH Reagent 0.01g DPPH + 20 ml of 100% methanol. Remove 5ml Dissolve 5 ml DPPH solution in 45 ml 100% methanol 0.06 Reagent must be freshly prepared to avoid oxidation Wrap the reagent bottle with aluminum foil because it is sensitive to Light. The principle of the DPPH method is that antioxidant compounds will donate their hydrogen atoms to DPPH radicals, causing DPPH to become a reduced form which is nonradical (Rohmah, 2020).

2.1.3 Antimicrobial Test

The media used is Nutrient Agar (NA) media. NA media is made by dissolving 28g of NA powder in 1000mL of distilled water, heating and stirring until homogeneous until clear in color, then sterilized in an autoclave at 121oC for 15 minutes with a pressure of 1 atm. While the media is still warm, add 20 mL into each sterile Petri dish and leave until it solidifies (Prasetyorini et al., 2019).

3. RESULTS AND DISCUSSION

Based on the analysis of variance (ANOVA) table with a non-factorial design, it shows that treatment with NPK fertilizer has a significant effect on the fresh weight of the leaves of the life-giving plant.

Table 1. Leaf fresh weight and Total Fresh Weight

No.	Treatment	Parameters	
		Leaf Fresh Weight	Total Fresh Weight
1	N_0 (0 g/ plants)	85,37 c	117,07 c
2	N_1 (3 g/ plants)	220,92 a	310,45 ab
3	N_2 (5 g/ plants)	188,73 b	257,57 b
4	N_3 (7 g/ plants)	217,43 ab	323,88 a

Based on Table 1, it was found that the fresh weight of leaves in the NPK N_1 fertilizer treatment (3g/plant) was 220.92 g, which was significantly different from the N_0 treatment

(0 g/plant) 85.37 g and the N_2 treatment (5 g/plant) 188.73 g but not significantly different from the N_3 treatment (7 g/plant) 217.43 g. Giving NPK at a certain dose can stimulate plant growth during the vegetative period, so that plant growth can be maximized. An increase in the amount of nutrient uptake in a balanced manner causes an increase in plant growth which can be seen in the increased formation of new plant organs such as an increase in the number of leaves (Utami et al., 2020). (Siregar, 2021) also states that husk ash contains macro and micro nutrients which function to support the growth of plant leaves. Nutrient availability factors can influence growth by stimulating the photosynthesis process so that plant biomass yields are maximized (Wijiyanti et al., 2019).

In Table 1, it was found that the total weight of plants in the NPK N_3 fertilizer treatment (7 g/plant) was 323.88 g, which was significantly different from the N_0 treatment (0 g/plant) 117.07 g and the N_2 treatment (5 g/plant) 257. 57g but not significantly different from the N_1 treatment (3 g/plant) 310.45 g. The total wet weight is caused by the content in NPK fertilizer which has an N content of 16%. In the vegetative phase, plants concentrate on forming roots, stems and leaves, so sufficient nitrogen is needed. In line with the statement (Prayoga and Muhamad, 2023) that nitrogen plays a role in stimulating overall plant growth, especially stems, branches and leaves. Nitrogen also plays a role in the formation of green leaf substances which are useful in the photosynthesis process.

Table 2. Effect of various doses of life-giving extract on various types of microbes

Treatment	*e. coli*	*b.cereus*	*c.sakazakii*	*e.aerugenes*	*L.innocua*	*S.aureus*
N_0	12.50b	13.00a	7.00a	13.50a	12.50a	14.00a
N_1	15.00a	11.50ab	7.00a	13.00a	9.25b	12.00a
N_2	10.25b	10.00b	7.00a	13.75a	12.25a	12.75a
N_3	11.00b	11.00b	7.50a	13.00a	13.75a	12.50a
Penicillin	7.00c	7.00c	7.00a	7.00b	7.00c	7.00b

Based on Table 2, it can be seen that the effect of various doses of sambungjiwa extract on several types of microbes provides significant results. Escherichia coli bacteria with Penicillin treatment gave significantly different results to treatments N_0, N_1, N_2, and N_3, while treatment N_1 was significantly different to N_0, N_2, and N_3. Bacillus cereus bacteria with Penicillin treatment gave significantly different results to treatments N_0, N_1, N_2, and N_3, while treatment N_0 was significantly different to N_2 and N_3, but not significantly different to N_1. For the Cronobacter sakazakii bacteria, all treatments gave results that were not significantly different. Enterobacter aerogenes bacteria with Penicillin treatment gave significantly different results to treatments N_0, N_1, N_2, and N_3. Listeria innocua bacteria with Penicillin treatment gave significantly different results to treatments N_0, N_1, N_2, and N3, while treatment N_1 was significantly different to treatments N_0, N_2, and N_3. Staphylococcus aureus bacteria with Penicillin treatment gave significantly different results to treatments N_0, N_1, N_2, and N_3. This is because the life-giving extract contains bioactive compounds such as saponins, tannins, alkaloids, terpenoids and phenolic compounds which have antibacterial potential. Alkaloids have antibacterial activity by interlacing bacterial DNA cell walls. Flavonoids have antibacterial activity by disrupting metabolic function through destroying cell walls and denaturing bacterial proteins. According to research (Nawi et al., 2019) sumbu leaf extract contains flavonoids, saponins, steroids and essential oils which can act as anti-inflammatory, antibacterial and antioxidant. Another compound contained is a phenolic compound which has an anti-bacterial effect by damaging microbial membranes and disrupting potassium ions in cells which can damage the cytoplasmic membrane (Artini,

2022). Staphylococcus aureus bacteria are gram-positive bacteria and are coccus-shaped which produce a purple color. gram staining (Hayati et al., 2019).

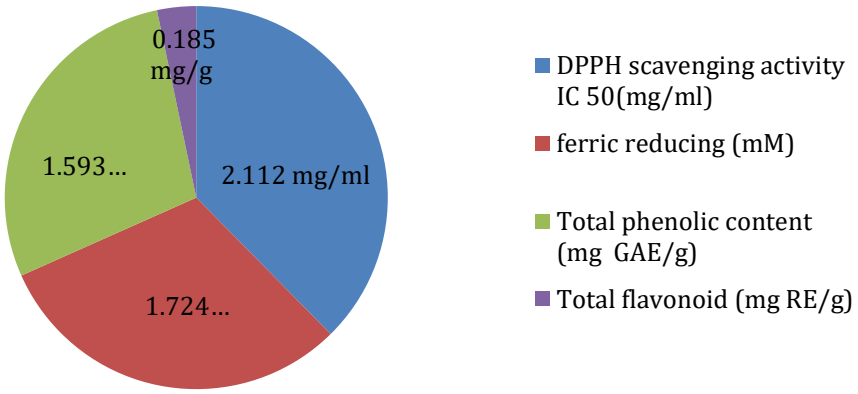

Figure 1. Amount of antioxidants in life-giving plants

Based on the circle diagram in Figure 1, the antioxidant DPPH scavenging activity IC50 level was found to be 2.112 mg/ml. Ferric reducing antioxidant power is 1,724 (mM), total phenolic content is 1,593 (mg GAE/g). Total flavonoid content was 0.185 (mg RE/g). The chemical content of semi-polar compounds such as flavonoids provides good antibacterial activity, because the activity of flavonoids, which are one of the phenol groups, has antibacterial activity by disrupting metabolic function through destroying cell walls and denaturing bacterial proteins. According to (Mulyani et al., 2021) stated that the use of life-giving plants as an antibacterial is supported by the presence of compounds that act as antibacterials such as flavonoids which play a very big role in inhibiting the growth and killing bacteria, besides that flavonoids can inhibit edema in infected tissue (anti-inflammatory) and can ward off free radicals (antioxidants).

4. CONCLUSIONS

Providing NPK fertilizer at a dose of 7 g/plant had a significant effect on fresh leaf weight and total leaf weight. The administration of Penicillin (N_3) had a significant effect on various types of microbes on the growth of the life-giving extract plant. Giving Listeria innocua bacteria is very good for the growth of life-giving extract. The amount of antioxidants in the life-giving extract is influenced by the chemical content of semi-polar compounds such as flavonoids which provide good antibacterial activity.

It would be better if this research was carried out better and more thoroughly and the application of fertilizer should be increased and different plants used.

THANK - YOU NOTE

Thanks to Wahyuni Umami Harahap S.P, M.P, Dr. Mirfat Binti Hj. Ahmad Hasan Salahuddin, Mohd Efendi Mohamed Nor, Izyani Raship, Dr. Samsiah Binti Jusoh, Noor Ismawaty Binti Nordin, Noor Safuraa Binti Samsudin, Muhammad Ikhwan Bin Mustaffa and all Friends who helped to complate this article.

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