Trends in Horticulture 2024, 7(2), 5575.
https://doi.org/10.24294/th.v7i2.5575

Article

The influence of monosodium glutamate dosage on the yield of long beans (*Vigna sinensis* L.) Peleton variety

Heny Mathelda Cornelia Sine, I. Komang Sudarma, Laurensius Lehar*

Department of Food Crops and Horticulture, State Agricultural Polytechnic of Kupang, Kupang City 85228, Indonesia
*** Corresponding author:** Laurensius Lehar, laurensiusl@yahoo.co.id

CITATION

Sine HMC, Sudarma IK, Lehar L. The influence of monosodium glutamate dosage on the yield of long beans (*Vigna sinensis* L.) Peleton variety. Trends in Horticulture. 2024; 7(2): 5575. https://doi.org/10.24294/th.v7i2.5575

ARTICLE INFO

Received: 1 April 2024
Accepted: 7 April 2024
Available online: 20 May 2024

Abstract: This study aims to determine the effects of monosodium glutamate (MSG) dosage on the yield of long beans (*Vigna sinensis* L.) of the Peleton variety. The use of MSG as a food ingredient has been a topic of debate, but research on its impact on plant growth is still limited, especially regarding long beans. Therefore, this research is important for providing further understanding of the influence of MSG on long beans plants. The study was conducted from July to October 2023 in Mata Air Village, Central Kupang District, Kupang Regency, East Nusa Tenggara Province. The research method used was a Randomized Complete Block Design (RCBD) with 9 treatments and 3 replications. The treatments included: No MSG, MSG at doses of 2.5 g/plant, 5 g/plant, 7.5 g/plant, 10 g/plant, 12.5 g/plant, 15 g/plant, 17.5 g/plant, and 20 g/plant. Parameters observed included flowering age (days), number of pods (pieces), pod length (cm), and pod weight (g). Based on the results and discussion, it can be concluded that MSG application had a significant effect on the number, length, and weight of pods, but had a non-significant effect on flowering age. The treatment of 15 g/plant was identified as the optimal MSG dosage for the plants, resulting in the highest number of pods (16.2), longest pod length (60.4 cm), and highest pod weight (256.4 g/plant). This research is innovative in exploring the potential use of monosodium glutamate (MSG) on long beans plants, particularly the Peleton variety. The focus on MSG application as a growth stimulant is an innovative step that has been less studied previously. The discovery of the optimal MSG dosage (15 g/plant) for achieving the best results provides valuable information for farmers to enhance productivity efficiently, sustainably, and environmentally friendly. Information about MSG's potential as a plant stimulant can serve as a starting point for more sustainable agricultural strategies aimed at optimizing available resources.

Keywords: long beans; dosage; monosodium glutamate; plant outcomes

1. Introduction

Long beans (*Vigna sinensis* L.) are among the high-value vegetable crops and serve as a significant food source for people across various parts of the world, including Indonesia. Typically grown for consumption as fresh vegetables or processed into various dishes, long beans hold considerable economic importance. Additionally, they boast high nutritional value, making it crucial to enhance their production to meet the dietary needs of communities.

In the cultivation of long beans, several factors influence plant growth and yield, one of which is the application of chemicals such as monosodium glutamate (MSG). MSG, a food additive commonly used as a flavor enhancer in various cuisines, remains relatively underexplored in its application to plant cultivation, particularly its impact on long beans yields.

The Peleton variety is one of the popular long beans varieties in Indonesia. Known for its high yield potential and adaptability to various environmental conditions, it presents a promising choice for cultivation. However, further research is needed to understand the effects of MSG dosage on the growth and production outcomes of Peleton long beans.

This study aims to investigate the influence of monosodium glutamate (MSG) dosage on the yield of Peleton variety long beans. In this context, MSG dosage refers to the amount applied during the plant growth process, with the assumption that MSG may affect the growth and development of long beans plants.

Previous studies have shown that the use of certain chemicals can impact the quality and quantity of crop yields. However, information regarding the effect of MSG dosage on long beans remains limited, especially for the Peleton variety. Therefore, this research is expected to provide a better understanding of the effects of MSG application on the growth and yield of long beans, particularly the Peleton variety.

Research findings suggest that one opportunity to increase pakcoy production is through the use of MSG [1]. The research results demonstrate that MSG contains N 5%, P 0.4%, and K 1.7%, which are highly beneficial to plants as they stimulate plant growth, especially in stems and leaves, and are essential for protein formation and various other organic compounds in plants. Furthermore, at a concentration of 15 g/plant, the best plant height was observed when MSG was applied; however, if MSG is applied at concentrations exceeding 15 g, plant height will decrease, even causing plant death. The research results also indicate that the optimum concentration of MSG used for peanut (Arachis hypogaea) growth is 6 g/plant. An MSG concentration of 6 g/plant provides the best plant height; however, if MSG is applied at concentrations exceeding 6 g, plant height will decrease, even causing plant death [2].

Therefore, this research aims to fill the existing knowledge gap and contribute to the development of more efficient and sustainable long beans cultivation techniques. The findings of this study are expected to serve as a basis for farmers and researchers to enhance long beans production optimally, thus supporting food security and community well-being. Through a deeper understanding of the effects of MSG dosage on Peleton variety long beans, appropriate solutions can be identified to optimize crop yields while minimizing potential negative impacts. Consequently, this research has the potential to significantly benefit agricultural development and food security in Indonesia.

2. Materials and methods

This research was conducted from July to October 2023 in Mata Air Village, Central Kupang District, Kupang Regency.

2.1. Research design

This study employed a Randomized Complete Block Design (RCBD) with monosodium glutamate (MSG) dosage as the treatment, consisting of nine levels and three replications, resulting in 27 experimental units. The treatments included: No

MSG, MSG = 2.5 g/plant, MSG = 5 g/plant, MSG = 7.5 g/plant, MSG = 10 g/plant, MSG = 12.5 g/plant, MSG = 15 g/plant, MSG = 17.5 g/plant, and MSG = 20 g/plant.

The MSG application on long bean plants was conducted twice, specifically at 2 weeks after planting (WAP) and 3 WAP. MSG was placed in plastic packets and weighed according to the dosage for each treatment, totaling 72 packets per treatment for each application. The MSG application was carried out in the morning to allow the plants to absorb nutrients from MSG for photosynthesis processes.

The first MSG application at 2 WAP involved sprinkling MSG on the soil around the plants at the following treatment dosages: M0 (no MSG), 2.5 g/plant, 5 g/plant, 7.5 g/plant, 10 g/plant, 12.5 g/plant, 15 g/plant, 17.5 g/plant, and 20 g/plant, followed by watering. The second application at 3 WAP followed the same procedure as the first application.

2.2. Observation variables

1) Flowering age (days): Observations on flowering age were conducted when 50% of all plants had bloomed.
2) Number of pods per plant (fruits): Observations on the number of pods per plant were conducted at harvest by counting the harvested pods on sample plants.
3) Pod length (cm): Pod length observations were measured using a ruler and meter, starting from the base to the tip of the pod on sample plants.
4) Pod weight per plant (g): Observations on pod weight per plant were conducted after harvest by weighing all harvested pods using an analytical balance.

2.3. Data analysis

The research data obtained were then analyzed using analysis of variance (ANOVA), and if there was a significant effect among treatments, it was followed by a further test using the Least Significant Difference (LSD) at the 5% level.

3. Results and discussion

3.1. Flowering age (days)

Flowering age refers to the time when the plant produces its first flower, calculated from the time the seeds are planted. The analysis of variance results indicate that the MSG treatment on long beans plants did not significantly affect the flowering age. The average flowering age of 50% of the long beans plants is presented in **Table 1**.

Table 1 presents data on the average age of 50% flowering, generally ranging from 34.0 to 36.0 DAP (days after planting). Despite showing no significant differences among treatments, plants without MSG exhibited the fastest average flowering age (34.0 DAP), while those treated with an MSG dosage of 17.5 g/plant showed the longest average flowering age (36.0 DAP).

Flowering age is influenced by genetic and environmental factors, including light intensity, temperature, and humidity. Day length or sunlight duration significantly affects flowering time [3]. Different plant varieties respond uniquely to sunlight, affecting the speed of the flowering process. Moreover, sunlight impacts

temperature, thereby influencing the generative process and accelerating flowering.

Table 1. Mean flowering age of 50% of long beans plants due to MSG application.

Treatment (MSG dosage)	Average age at 50% bloom (days)
Without MSG	34.0
2.5 g/plant	35.7
5 g/plant	34.3
7.5 g/plant	35.7
10 g/plant	35.3
12.5 g/plant	35.7
15 g/plant	35.3
17.5 g/plant	36.0
20 g/plant	35.7
LSD 5%	ns

Note: ns = not significant.

The observed 50% flowering age for long beans plants in this study occurred several days earlier compared to the description of the plant variety, ranging from 34.0 to 36.0 DAP. This discrepancy is attributed to environmental factors, particularly sunlight intensity and duration, as well as air temperature. The average air temperature during the research period from July to October 2023 in Mata Air Village was 27.3 ℃, higher than the optimum temperature for long beans growth. The ideal air temperature for long beans ranges from 18 to 32 ℃, with an optimum growth temperature of 25 ℃ [3,4]. Long beans plants require ample sunlight and annual rainfall between 600 and 2000 mm. The higher air temperature during the research period, compared to the optimum temperature for long beans growth, led to accelerated plant growth and early flowering.

Another environmental factor influencing the flowering process is the availability of nutrients and hormones for plants. Phosphorus (P) nutrients play crucial roles in protein and carbohydrate synthesis, stimulate flower and seed formation, and determine seed germination ability. Flower formation is significantly influenced by environmental factors, marking the transition from the vegetative phase to the generative phase [5,6]. The suspected earlier transition phase is attributed to the presence of MSG. MSG contains 5% N, 0.4% P, and 1.7% K [1]. Consistent with [7], which states that MSG application accelerates flowering (acting as a catalyst), MSG contains components that function as growth-stimulating hormones like gibberellins, redirecting cells initially intended for leaf bud growth towards flower bud growth.

3.2. Number of pods per plant (fruit)

The analysis of variance shows that the MSG dosage treatment significantly affects the number of pods per plant in long beans plants. The average number of pods per long beans plant is presented in **Table 2**.

Table 2. Average number of pods per plant due to MSG application.

Treatment (MSG dosage)	Average number of pods per plant
Without MSG	8.8 a
2.5 g/plant	10.4 cd
5 g/plant	10.8 cd
7.5 g/plant	11.1 de
10 g/plant	11.9 e
12.5 g/plant	13.8 f
15 g/plant	16.2 g
17.5 g/plant	9.9 bc
20 g/plant	9.1 ab
LSD 5%	0.87

Note: Numbers followed by the same letter are not significantly different based on the Tukey's Honestly Significant Difference (HSD) test.

The highest average number of pods was obtained in the MSG 15 g/plant treatment, which was significantly different from the other treatments. MSG dosage treatments ranging from 2.5 to 17.5 g/plant had a significantly different and higher number of pods compared to the treatment without MSG. Furthermore, the lowest number of pods was found in the treatment without MSG, which was not significantly different from the MSG 20 g/plant treatment. This indicates that increasing MSG dosage contributes nutrients, especially N, P, and K, to the growing medium, which are then absorbed by the plant roots and utilized by long beans plants for their growth. However, after reaching the optimum requirement, further increases in MSG dosage do not increase the number of pods; instead, they result in a decrease in pod count.

MSG contains essential nutrients such as N, P, and K for plants. Nitrogen (N) aids in the photosynthesis process by producing chlorophyll that is absorbed by plants, and it also functions in protein formation [7]. Phosphorus (P) plays a role in transporting energy from metabolic processes and stimulates fertilization. Potassium (K) is involved in photosynthesis, the transport of assimilates, enzymes, and minerals, including water and sulfur, which are essential for amino acid formation and shoot growth [8].

3.3. Pod length per plant (cm)

The MSG dosage treatment significantly affects the pod length per plant. The average pod length is shown in **Table 3**.

The average length of long beans pods per plant tends to increase with increasing MSG dosage. However, doses of MSG above 15 g/plant result in shorter pod lengths. The longest long beans pod is found in the 15 g/plant MSG dosage treatment (60.4 cm) and significantly differs from the other treatments except for the 12.5 g/plant MSG treatment.

The length of long beans pods is influenced by the amount of photosynthate produced and can be transported to the pod. The amount of photosynthate produced by plants is related to the number of leaves and the availability of nutrients and

water. This indicates that the rate of photosynthesis is controlled by the availability of nutrients and water, which will determine fruit production [9,10]. Consistent with the number of pods per plant, the 15 g/plant MSG dosage is also able to produce the longest pods compared to other treatments. This indicates that the 15 g/plant MSG dosage is the optimum dose for long beans plants to meet all their needs, especially nutrients, to produce the best long beans plant growth, which is ultimately reflected in the highest number and longest pods compared to other treatments.

Table 3. Average pod length per plant due to MSG application.

Treatment (MSG dosage)	Average pod length per plant (cm)
Without MSG	42.0 a
2.5 g/plant	48.6 b
5 g/plant	51.5 bc
7.5 g/plant	48.0 b
10 g/plant	51.6 bc
12.5 g/plant	55.3 cd
15 g/plant	60.4 d
17.5 g/plant	48.0 b
20 g/plant	46.5 ab
LSD 5%	3.68

Note: Numbers followed by the same letter are not significantly different based on the Tukey's Honestly Significant Difference (HSD) test.

The number of pods formed indicates the ability of long beans plants to absorb nutrients available in the soil. This is because pods are one of the places to store plant food reserves. During pod filling, the pods become assimilate distribution areas, with most assimilates used to increase seed weight [11]. Pod formation depends on the soil moisture level and the availability of nutrients, especially P and K, for the fruit and seed formation process. Pod formation requires a sufficiently high moisture content for some time and sufficient nutrients, but too much water in the soil can also disrupt pod formation [12].

Plant growth and productivity are heavily influenced by the process of photosynthesis, in which plants produce organic compounds known as photosynthates. The amount of photosynthates produced by plants depends on the availability of nutrients and water in the soil. This means that plants require sufficient nutrients and water to carry out photosynthesis effectively. The availability of nutrients and water will affect the speed and efficiency of photosynthesis, which in turn will impact overall plant growth and productivity [10–13].

4. Conclusion

Based on the research results and discussions, it can be concluded that the application of MSG significantly affects the number, length, and weight of pods, while it has no significant effect on flowering age. Treatment M6 (15 g/plant) is the best MSG dosage for plants as it provides the highest number of pods (16.2), longest pod length (60.4 cm), and highest pod weight (256.4 g).

Author contributions: Conceptualization, HMCS and IKS; methodology, LL; software, IKS; validation, HMCS, IKS and LL; formal analysis, HMCS; investigation, LL; resources, LL; data curation, LL; writing—original draft preparation, HMCS; writing—review and editing, LL; visualization, IKS; supervision, LL; project administration, HMCS; funding acquisition, LL. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

References

1. Azzahrawani E. Quality of Liquid Fertilizer from Monosodium Glutamate (MSG) Waste with the Addition of Organic Nutrient Sources Bone Meal and Guano Fermented and Non-fermented with Cow Rumen Content. Faculty of Animal Husbandry, Bogor Agricultural University; 2010.
2. Gresinta E. Effect of Monosodium Glutamate (MSG) Application on the Growth and Yield of Peanut (Arachis hypogaea L.). Journal, Factor Exacta. 2015; 8(3): 208-219.
3. Sosylowati WLF. Effect of Concentration of Liquid Organic Fertilizer (POC) on the Growth and Yield of Several Soybean Varieties (Glycine max (L) Merril). Ziraa'ah Majalah Ilmiah Pertanian. 2016; (1): 84-96. doi: 10.31602/zmip.v41i1.331
4. Somaatmadja S. The Resource Process of Southeast Asian Plant 1 Legumes. Gramedia Pustaka Utama, Jakarta; 1993.
5. Wijaya KA. Plant Nutrition as a Determinant of Yield Quality and Resistance and Efficiency. Penebar Swadaya, Jakarta; 2008.
6. Lehar L. Testing of organic fertilizers with biological agents (Trichoderma sp) on potato growth (Solanum tuberosum L.). Journal of Applied Agricultural Research. 2012; 12(2): 115-124.
7. Sandra E. Making Orchids Bloom Diligently. Jakarta: Agromedia Pustaka, South Jakarta; 2005, p. 48.
8. Fanindi A, Yohaeni S, Sutedi E, et al. Produksi Forage and Legume Seeds Arachis pintoi at Various Fertilizer Doses. Soil Research Institute, Bogor; 2009.
9. Shinta K, Warisnu A. Effect of Biofertilizer Application on the Growth and Productivity of Chili Plants (Capsicum frutescens L.). Journal of Science and Art Pomits. 2014; 2(1): 2337-3520.
10. Zannah H, Salfa Zahroh A, Evie R, et al. The Role of Sunlight in the Photosynthesis Process of Plants. Mirror: Research Journal. 2023; 7(1): 204-214.
11. Gardner FP, Pearce RB, Mitchell RL. Crop Physiology. UI-Press, Jakarta; 1991. 428p.
12. Irdiawan R, Rahmi A. Effect of Planting Distance and Application of Chicken Manure Bokhasi on the Growth and Yield of Peanut (Arachys hypogeae L.). Agrifor Journal. 2002; 1(2): 31-36.
13. Safuan LO, Bahrun A. Effect of Organic Material and Potassium Fertilizer on the Growth and Production of Melon Plants (Cucumis melo L.). Agrotechnos Journal. 2012; (2): 69-76.