

Effect of Growing Media Composition and Kepok Banana Peel Liquid Organic Fertilizer on Sesame (*Sesamum indicum* L.) Production

Amarullah^{1*} and Nova Suryana¹

¹Faculty of Agriculture, Universitas Borneo Tarakan, Tarakan, Indonesia

* Corresponding author. E-mail address: amarullah70@gmail.com

Submitted/Received: 20 January 2025; Accepted: 16 March 2025.

ARTICLE INFO

Keywords:

Banana peel liquid organic fertilizer
Growing media
Kepok banana peel
Sawdust
Sesame

ABSTRACT

This study aimed to analyze the effect of growing media composition and kepok banana peel liquid organic fertilizer (LOF) on the growth and production of sesame (*Sesamum indicum* L.). The study used a two-factor factorial randomized block design. The first factor was growing media composition, consisting of M0 (soil + chicken manure, 2:1), M1 (soil + chicken manure + fern roots, 1:1:1), and M2 (soil + chicken manure + sawdust, 1:1:1). The second factor was the concentration of kepok banana peel LOF, consisting of P1 (100 mL/L), P2 (150 mL/L), and P3 (200 mL/L). The treatment combination was repeated in three blocks with three sample plants per experimental unit, producing 81 observed plant samples. The observed parameters included vegetative growth and production components. The results showed that growing media composition significantly affected sesame growth and production, with M2 producing the best overall performance. The best LOF concentration was P2 (150 mL/L). The interaction between growing media and LOF concentration did not significantly affect all observed parameters. Therefore, the use of soil + chicken manure + sawdust (1:1:1) combined with kepok banana peel LOF at 150 mL/L is recommended to improve sesame production under the conditions of this study.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an oilseed crop with high adaptability to various agroecosystems and an important role in sustainable agricultural systems through intercropping, crop rotation, and its contribution to soil fertility [1]. Sesame seed also has high nutritional value and is associated with several health benefits, resulting in increasing demand for this commodity [2]. However, sesame production still faces several constraints, particularly those related to cultivation techniques and the management of suitable growing media [3].

The use of organic materials as components of growing media is one alternative strategy to improve sesame productivity in a sustainable manner. Fern roots (*Cyathea contaminans*) have a fibrous, lightweight, and porous structure that can improve aeration and drainage in growing media and support vegetative growth [4]. Sawdust, as an organic waste material, also has the potential to improve the physical properties of soil, particularly by increasing porosity and water-holding capacity [5]. Combinations of soil, chicken manure, fern

roots, and sawdust have been widely used in various ratios as growing media; however, their effectiveness varies depending on the plant species and environmental conditions.

In addition to growing media, liquid organic fertilizer (LOF) can support crop growth while reducing dependence on inorganic fertilizers. Kepok banana peel waste contains important nutrients such as nitrogen, phosphorus, and potassium, which may contribute to plant growth and yield formation [6]. Several studies have reported that banana peel LOF can improve growth and yield in horticultural crops [7].

Nevertheless, studies evaluating the combined use of organic-material-based growing media, especially fern roots and sawdust, with kepok banana peel LOF on sesame plants remain limited. Information is also still insufficient regarding the most effective combination of these treatments for improving vegetative growth and production. Therefore, this study was conducted to analyze the effect of growing media composition and kepok banana peel LOF application on the growth and production of sesame (*Sesamum indicum* L.) and to determine the best treatment combination.

MATERIALS AND METHODS

Research Design and Treatments

This research was conducted as an experimental study using a two-factor factorial randomized block design (RBD). The first factor was growing media composition (M), consisting of M0 (soil + chicken manure, 2:1), M1 (soil + chicken manure + fern roots, 1:1:1), and M2 (soil

+ chicken manure + sawdust, 1:1:1). The second factor was the concentration of kepok banana peel liquid organic fertilizer (P), consisting of P1 (100 mL/L water), P2 (150 mL/L water), and P3 (200 mL/L water). The factorial arrangement produced nine treatment combinations, which were repeated in three blocks. Each treatment unit contained three sample plants, resulting in 81 observed plant samples.

Table 1. Treatment factors and levels used in the factorial randomized block design

Factor	Code	Treatment level
Growing media	M0	Soil + chicken manure (2:1)
Growing media	M1	Soil + chicken manure + fern roots (1:1:1)
Growing media	M2	Soil + chicken manure + sawdust (1:1:1)
Kepok banana peel LOF	P1	100 mL/L water
Kepok banana peel LOF	P2	150 mL/L water
Kepok banana peel LOF	P3	200 mL/L water

Planting Media Preparation and LOF Production

The experiment was carried out in polybags arranged at a spacing of 10 cm x 10 cm, with 30 cm between treatment groups. The growing media were prepared using soil, mature chicken manure, and the specified organic materials, namely fern roots or sawdust. The materials were dried and mixed according to the treatment ratios before being placed into polybags. Kepok banana peel LOF was prepared through fermentation using EM4 and molasses for approximately 14 days. After fermentation, the liquid fertilizer was filtered before application.

Planting and Maintenance

The planting material used in this study was sesame seed of the Sumberejo 2 variety. Planting was carried out by sowing three to four seeds per hole at a depth of approximately 3 cm. After normal seedling establishment, the plants were thinned to one plant per planting hole. Plant maintenance included watering, weed control, fertilization according to the treatment, and pest and disease management as needed. Harvesting was conducted at approximately 105 days after planting.

Observed Parameters and Data Analysis

The observed parameters included both vegetative and generative growth components. Vegetative parameters consisted of plant height, number of leaves, leaf length,

leaf width, number of branches, and stem diameter, which were observed at 3, 4, 5, and 6 weeks after planting (WAP) or according to the observed growth stage. Generative and production parameters included the number of capsules, capsule size, fresh and dry capsule weight, and seed weight.

The collected data were analyzed using analysis of variance (ANOVA) at the 5% significance level. When significant differences were detected among treatments, mean separation was performed using the Duncan Multiple Range Test (DMRT) at the 5% level.

RESULTS AND DISCUSSION

Vegetative Growth Parameters

In general, the analysis indicated that growing media (M) were the main factor influencing sesame growth parameters at 4-7 WAP. Banana peel LOF (P) had a more limited effect, and no interaction between the two factors (M x P) was detected. The growth trends for plant height and number of leaves showed that the growing medium supplemented with sawdust (M2) consistently produced the highest growth from the early observation stage to the end of observation. At 6-7 WAP, M2 showed the most evident increase compared with M0 (soil + chicken manure) and M1 (soil + chicken manure + fern roots).

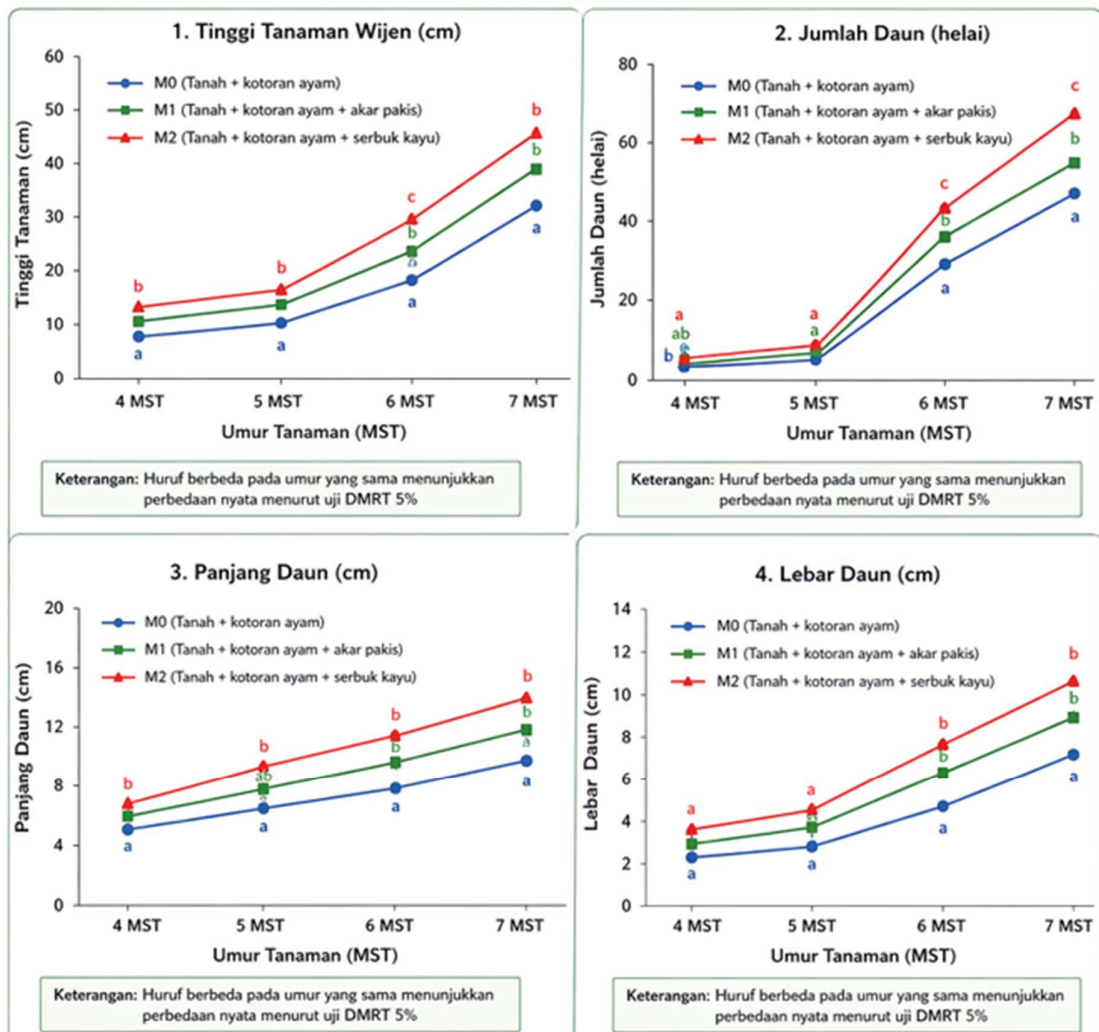


Figure 1. Vegetative growth parameters of sesame under different growing media treatments. Different letters at the same plant age indicate significant differences based on DMRT at 5%. MST in the original figure refers to weeks after planting.

A similar pattern was observed for leaf length and leaf width. During the early growth stage, particularly at 4-5 WAP, the effect of growing media was more dominant, whereas the effect of LOF became more visible at later stages, although it was not consistent across all parameters. These results suggest that LOF functioned more as a supporting factor than as the main determinant of vegetative growth.

The number of branches and stem diameter also showed the same tendency, with M2 producing the highest values. This indicates that the addition of sawdust to the growing medium may create a more favorable root environment. Physiologically, the advantage of M2 was likely related to improved aeration and porosity, better water retention, and enhanced soil microbial activity.

However, the use of sawdust must be managed carefully because its high C/N ratio may cause nitrogen immobilization when the material is not sufficiently decomposed.

Production Parameters

The analysis of production parameters showed that growing media significantly affected the number and length of capsules, whereas LOF concentration and the interaction between growing media and LOF did not significantly affect these production parameters. The comparison among media treatments indicated that M2 produced the highest number of capsules and the greatest capsule length, with significant differences compared with M0 and M1. Meanwhile, M0 and M1 did not show substantial differences.

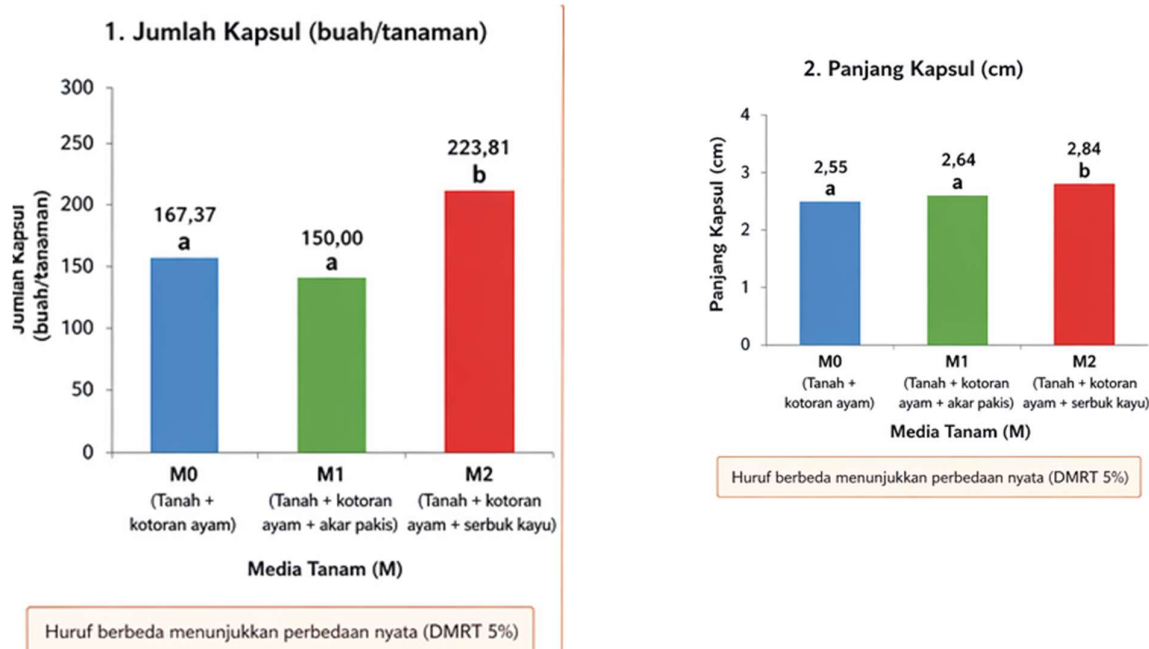


Figure 2. Number of capsules and capsule length of sesame under different growing media treatments. Different letters indicate significant differences based on DMRT at 5%.

Table 2. Summary of treatment effects on sesame vegetative growth parameters

Parameter	Growing media (M)	LOF (P)	Interaction (M x P)
Plant height	**	ns	ns
Number of leaves	**	ns	ns
Leaf length	**	* (6-7 WAP)	ns
Leaf width	**	* (6-7 WAP)	ns
Number of branches	**	ns	ns
Stem diameter	**	* (4 WAP)	ns

Note: ** = highly significant effect ($p \leq 0.01$); * = significant effect ($p \leq 0.05$); ns = not significant ($p > 0.05$); WAP = weeks after planting.

Table 3. Summary of treatment effects on sesame production parameters

Parameter	Growing media (M)	LOF (P)	Interaction (M x P)
Number of capsules	**	ns	ns
Capsule length	**	ns	ns
Capsule diameter	ns	ns	ns
Fresh capsule weight	ns	ns	ns
Dry capsule weight	ns	ns	ns

Note: ** = highly significant effect ($p \leq 0.01$); ns = not significant ($p > 0.05$); LOF = liquid organic fertilizer.

The increase in production under M2 was likely associated with a looser media structure, more optimal root development, and more efficient uptake of nutrients, particularly N, P, and K from chicken manure. These conditions support the generative phase of sesame, especially flowering and capsule formation. In contrast, M1, which included fern roots, did not significantly improve production. This may be due to lower nutrient availability and a high C/N ratio, which can slow decomposition and nutrient release. Thus, fern roots may function more as a physical media amendment than as a major nutrient source.

DISCUSSION

The overall results demonstrate that growing media composition was the dominant factor determining sesame growth and production. The combination of soil,

chicken manure, and sawdust (M2) consistently produced better vegetative growth and higher production performance than the other media treatments. This finding supports the idea that improvement of physical media properties can be as important as nutrient supplementation in container-based crop production.

Sawdust may improve the physical environment of the root zone by increasing porosity, enhancing drainage, and maintaining an adequate balance between water retention and air availability. In sesame, a favorable root environment is essential because vegetative growth strongly supports the transition to the reproductive phase. Improved plant height, leaf development, stem diameter, and branch formation may increase photosynthetic capacity and assimilate supply,

which subsequently supports capsule formation and seed development.

The limited effect of kepok banana peel LOF suggests that nutrient application through liquid organic fertilizer alone was not sufficient to overcome the influence of growing media. Although banana peel contains nutrients such as potassium and other minerals, the availability of these nutrients depends on fermentation quality, dilution rate, application frequency, and the ability of the plant to absorb nutrients during specific growth stages. The treatment P2 (150 mL/L) was identified as the best LOF concentration in this study, indicating that a moderate concentration may provide a better balance than lower or higher concentrations.

The absence of significant interaction between growing media and LOF concentration indicates that the response of sesame to LOF did not depend strongly on the type of media used. In practical terms, this means that the improvement in growth and production was mainly driven by the growing media, especially the M2 medium, rather than by a specific combination of media and LOF. Nevertheless, the combined performance of M2 with banana peel LOF still provides useful information for sustainable sesame cultivation using locally available organic materials.

These findings have practical implications for small-scale sesame production. Farmers or growers may use sawdust-based media mixtures with chicken manure as an alternative medium to improve sesame growth. However, sawdust should be properly decomposed or pretreated before use to minimize nitrogen immobilization. Future research should measure soil chemical properties, nutrient release patterns, root development, and seed yield quality to provide a stronger explanation of the mechanisms underlying the observed responses.

CONCLUSION

The study showed that growing media composition significantly affected the vegetative growth and production of sesame. The best overall growing medium was M2, consisting of soil + chicken manure + sawdust at a ratio of 1:1:1, which produced the most optimal growth and production performance. The best kepok banana peel liquid organic fertilizer concentration was P2 (150 mL/L water). However, the interaction between growing media composition and LOF concentration did not significantly affect all observed parameters. Although the highest combined treatment value was observed in M2P1 with a value of 76.33, the overall recommendation from this study is to use the M2 growing medium and apply kepok banana peel LOF at an appropriate concentration to support sesame production under similar cultivation conditions.

ACKNOWLEDGMENT

The authors would like to thank the Faculty of Agriculture, Universitas Borneo Tarakan, for supporting

the implementation of this research. Appreciation is also extended to all individuals who assisted during field preparation, observation, and data collection.

REFERENCES

- [1] Wacal, C., Simon, P. M., Emmanuel, E., Christopher, A., Docus, A., & Jorem, A. (2024). Unveiling the potential benefits of sesame (*Sesamum indicum* L.) in farming systems, nutrition, health, and industrial applications of its seeds: A review. *Cogent Food & Agriculture*, 10(1), 2360766. <https://doi.org/10.1080/23311932.2024.2360766>
- [2] Abbas, S., Sharif, K. M., Sibte-Abbas, M., Teferra, F. T., Sultan, T. M., & Anwar, J. M. (2022). Nutritional and therapeutic potential of sesame seeds. *Journal of Food Quality*, 2022, 1-19. <https://doi.org/10.1155/2022/6163753>
- [3] Myint, D., Gilani, S. A., Kawase, M., & Watanabe, K. N. (2020). Sustainable sesame (*Sesamum indicum* L.) production through improved technology: An overview of production, challenges, and opportunities in Myanmar. *Sustainability*, 12(9), 3515. <https://doi.org/10.3390/su12093515>
- [4] Nopriadi, N., Haitami, A., & Seprido, S. (2021). Uji berbagai media tanam terhadap pertumbuhan dan produksi tanaman romaine (*Lactuca sativa* var. *longifolia*) secara hidroponik sistem NFT. *Green Swarnadwipa: Jurnal Pengembangan Ilmu Pertanian*, 10(3), 414-421.
- [5] Salman, N. (2022). Potensi serbuk gergaji sebagai bahan pupuk kompos. *Jurnal Komposit*, 4(1), 1-7.
- [6] Aulady, N. A., Sularno, Rosdiana, Putri, D., & Wulandari, Y. A. (2024). Pengaruh pemberian POC pisang kepok terhadap pertumbuhan dan produksi tanaman bawang merah. *Jurnal Agrosains dan Teknologi*, 9(1), 30-35.
- [7] Kartana, S. N., Nurhadiyah, H., & Rahman, H. (2024). Pengaruh pupuk organik cair (POC) kulit pisang terhadap pertumbuhan dan hasil terung ungu pada tanah podsolik merah kuning. *PIPER*, 20(1).