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The Effect of Blotong Compost on the Growth and Yield of Peanut (*Arachis hypogaea* L.)

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Abstract
Peanut productivity in Indonesia needs to be improved through nutrient management, one method of which is the use of blotong compost. This study aims to analyze the effect of blotong compost application rates on the growth and yield of peanut plants and to determine the application rate that produces the highest values for the observed variables. The study was conducted from March to June 2026 in Nanggela Village, Mandirancan Subdistrict, Kuningan Regency, West Java, using a randomized block design with blotong compost application rates of 0, 9, 12, 15, and 18 tons ha^{-1}, each repeated five times. Data were analyzed using analysis of variance (ANOVA) and Duncan's multiple range test at the 5% significance level. The observed variables included plant height, number of leaves, stem diameter, pod weight per plant, pod weight per plot, seed weight per plant, and weight of 100 seeds. The results showed that the 18 tons ha^{-1} application rate produced the highest values for most growth and yield variables. Pod weight per plot at application rates of 9–18 tons ha^{-1} did not differ significantly. Plant height and number of leaves at 28 days after sowing (DAS) showed a moderate and significant positive correlation with pod weight per plot, while stem diameter showed a low and insignificant positive correlation.

Keywords: Application Rate; Blotong Compost; Growth; Peanut; Yield

Introduction

Peanut (*Arachis hypogaea* L.) are one of Indonesia's key food commodities, serving as a source of plant-based protein and oil. Demand for peanuts continues to rise in tandem with population growth, increasing public awareness of nutritional needs, and the expansion of the food industry, which uses peanut as a raw material (Hapsoh et al., 2023). According to data from the Central Statistics Agency (BPS, 2024), peanut yields in Indonesia during the 2019–2023 period fluctuated but showed a downward trend. Although yields briefly increased from 12.62 quintals ha^{-1} in 2019 to 13.40 quintals ha^{-1} in 2022, they subsequently declined to 13.09 quintals ha^{-1} in 2023. This decline aligns with a reduction in harvested area and resulted in a decrease in national peanut production of approximately 16.7% during that period.

Nutrient availability is one of the factors influencing the growth and yield of groundnut crops. Inappropriate nutrient management can pose a challenge in cultivation because it affects plant growth and yield formation (Kurniawan et al., 2017). The continuous use of inorganic fertilizers without being balanced by the application of organic matter also has the potential to reduce organic matter content and soil quality (Alvianak et al., 2021). The application of organic matter is necessary to improve the physical, chemical, and biological properties of the soil, thereby increasing nutrient availability and supporting sustainable plant growth (Nurmi et al., 2023).

One organic material with potential for use as fertilizer is blotong compost. Blotong (*filter cake*) is a solid waste produced during sugarcane processing in the sugar industry and can be used as a

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raw material for organic fertilizer after undergoing a composting process. Blotong compost contains organic matter and nutrients that can help improve the physical, chemical, and biological properties of the soil and increase the availability of nutrients for plants (Irawan et al., 2024). The use of blotong compost can also serve as a means to reduce waste from the sugar industry while increasing the utilization of organic resources in crop cultivation.

The application of blotong compost has shown positive effects on several crops. Kaharuddin et al. (2020) reported that applying 12 tons ha^{-1} of blotong compost had a positive effect on plant height, leaf number, and glutinous corn yield. In mung beans, applying 10 tons ha^{-1} of blotong compost increased the number of pods and pod weight (Azhari & Soverda, 2018). However, these studies were conducted on different crops and therefore do not provide information on the response of groundnut plants to blotong compost application at various application rates, particularly regarding growth and yield components. Therefore, research on the effects of blotong compost application at various rates on the growth and yield of groundnut plants is needed.

Literature Review

Blotong compost is an organic material derived from solid waste produced during sugarcane processing and can be used in crop cultivation after undergoing a composting process. Blotong compost contains organic matter and a number of nutrients that have the potential to improve soil conditions and support nutrient availability for plants. The addition of organic matter can improve the physical and chemical properties of the soil and support soil biological activity. During the decomposition process, organic matter can gradually release nutrients, thereby supporting water and nutrient uptake by plants (Prado et al., 2013).

Peanut plant growth can be observed through plant height, number of leaves, and stem diameter. Plant height is related to the increase in plant size through cell division and elongation. The number of leaves indicates the formation of leaf organs during the vegetative phase, while stem diameter reflects the increase in the size of the tissues comprising the stem. Vegetative growth is influenced by the availability of water, nutrients, and environmental conditions. Nitrogen plays a role in the formation of vegetative tissues; phosphorus supports root development and plant metabolism; and potassium plays a role in water regulation and plant physiological processes. Adequate nutrient availability can support peanut plant growth until the crop enters the yield formation phase (Sudjatmiko et al., 2023).

Peanut yield can be assessed based on pod weight per plant, pod weight per plot, seed weight per plant, and the weight of 100 seeds. Pod weight reflects the yield of pods formed, while seed weight indicates the yield of seeds produced by the plant. The weight of 100 seeds can be used to assess seed size and filling. Pod and seed formation and filling are influenced by the availability of water and nutrients during plant growth. Soil conditions that support root development and sufficient nutrient availability can promote pod formation and seed filling. The application of blotong compost has the potential to enhance yield components by improving soil conditions and nutrient availability.

Purwaningsih (2011) reported that the application of blotong compost can increase nitrogen and phosphorus uptake in groundnut plants. Hamzah et al. (2019) demonstrated that the use of blotong compost as a soil amendment can improve soil conditions and increase groundnut yields. Kencana (2023) reported that the application of a combination of empty oil palm fruit bunch (EOPFB) compost and blotong compost can increase fresh pod weight, seed number, and seed dry weight. Henrique et al. (2026) also demonstrated that the use of enriched blotong compost can increase crop productivity.

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Based on previous research, blotong compost has the potential to support plant growth and yield by improving soil conditions and nutrient availability. However, plant responses to blotong compost application may vary depending on the dose and environmental conditions. Therefore, testing various doses of blotong compost is necessary to determine the growth and yield responses of groundnut plants and to identify the dose that yields the highest values for the observed variables.

Research Method

This study was conducted from March to June 2026 in Nanggela Village, Mandirancan Subdistrict, Kuningan Regency, West Java Province, at coordinates 6°48' S and 108°28' E, with an average temperature of 22–26 °C. The materials used included Gajah variety peanut seeds, blotong compost, and 16-16-16 NPK fertilizer. NPK fertilizer was applied at a rate of 250 kg ha^{-1} as recommended by Kariya et al. (2022), equivalent to 100 g per plot per application. The tools used included a hoe, a dibble, a measuring tape, a ruler, a digital scale, a vernier caliper, and other supporting equipment. The study employed a single-factor randomized block design (RBD) with five levels of blotong compost application rates: 0, 9, 12, 15, and 18 tons ha^{-1}; each treatment was replicated five times, resulting in 25 experimental units. The selection of application rates was based on a study by Kaharuddin et al. (2020), which showed that applying 12 tons ha^{-1} of blotong compost resulted in the highest growth and yield of waxy corn. Based on that study, the range of application rates was expanded to 18 tons ha^{-1} to evaluate the growth and yield responses of groundnut plants to increasing doses of blotong compost. Each plot measured 2 m × 2 m with 50 planting holes spaced 40 cm × 20 cm apart.

Land preparation was carried out 10 days before planting. Blotong compost was applied as a base fertilizer at the treatment-specific rates seven days before planting. Seeds were planted at a depth of 3–5 cm, two seeds per planting hole, and then covered with burnt rice husks. After the plants emerged, thinning was performed to leave one plant per hole. NPK 16-16-16 fertilizer was applied at 15 and 29 days after planting (DAP). During the growth period, the plants were maintained through weeding, irrigation, and pest and disease control according to the plants' condition. Harvesting was conducted at 110 DAS based on the following criteria: leaves beginning to turn yellow and dry, stems drying out, and pods having fully developed and become hard in texture.

Observation variables included plant height, number of leaves, stem diameter, pod weight per plant, pod weight per plot, seed weight per plant, and weight of 100 seeds. Growth observations were conducted at 14, 21, and 28 days after sowing (DAS), while yield component observations were conducted after harvest. Growth observations were performed on five sample plants per plot, randomly selected from the center of the plot. Sample plants were marked and consistently observed at each observation time. Edge plants were not used as samples to minimize the influence of edge plants. Pod weight per plant and seed weight per plant were determined based on the sample plants, while pod weight per plot was calculated based on the harvest yield of all plants in the plot.

The observation data were analyzed using analysis of variance (ANOVA). If the F-test results indicated a significant effect, the analysis was continued using the Duncan's Multiple Range Test (DMRT) at the 5% level. The relationship between growth components at 28 days after sowing and pod weight per plot was analyzed using Pearson's product-moment correlation. Data analysis was performed using Microsoft Excel and SPSS.

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Results and Discussion

Analysis of Soil Fertility and Blotong Compost

Soil Fertility Analysis

The results of the soil analysis conducted prior to the study showed a pH (H_2O) of 6.04, organic carbon of 1.32%, total nitrogen of 0.19%, cation exchange capacity (CEC) of 19.0 cmol(+) kg^{-1}, Olsen P of 71.4 ppm P_2O_5, and Olsen K of 113 ppm K_2O. Soil texture analysis results showed a sand content of 16.60%, silt content of 36.65%, and clay content of 46.75%.

Blotong Compost Analysis

The blotong compost used had a moisture content of 33.91%, organic carbon 10.41%, pH 6.98, total nitrogen 0.73%, total P_2O_5 1.19%, total K_2O 0.28%, and a C/N ratio of 14.3.

Discussion

The pH value of H_2O at 6.04 indicates that the soil is slightly acidic. Organic carbon at 1.32% and total nitrogen at 0.19% indicate relatively low levels of organic matter and nitrogen. These conditions indicate the need to add organic matter to improve soil conditions and nutrient availability. This is consistent with the findings from Mangungsong et al. (2019), who reported that adding organic matter can improve soil properties and support nutrient availability for plants. Cation exchange capacity (CEC) of 19.0 cmol(+) kg^{-1} indicates moderate cation exchange capacity, while Olsen P at 71.4 ppm P_2O_5 and Olsen K at 113 ppm K_2O indicate that P and K were already available prior to treatment.

A C/N ratio of 14.3 indicates that the blotong compost had undergone relatively good decomposition (Bimantara et al., 2026). Organic carbon at 10.41% indicates the presence of organic matter that can support soil improvement. The compost also contains 0.73% total N, 1.19% P_2O_5, and 0.28% K_2O, which can provide additional nutrients for plants. However, the relatively low K_2O content suggests that the compost's contribution to potassium supply is limited. A pH value of 6.98, which is close to neutral, supports the use of blotong compost as an organic material in crop cultivation (Rosniawaty & Utami, 2018).

Plant Growth Variables.

Plant Height (cm)

Table 1. Average Plant Height (cm) of Peanut Plants

Treatment	14 DAP	21 DAP	28 DAP
Control	7.42 a	11.58 a	17.46 a
9 tons ha^{-1}	7.74 b	12.26 b	18.24 b
12 tons ha^{-1}	7.89 c	12.52 bc	18.40 b
15 tons ha^{-1}	8.32 d	12.98 cd	19.26 c
18 tons ha^{-1}	8.48 d	13.48 c	20.22 d

Note: Numbers followed by the same lowercase letter in the same column indicate no significant difference based on the DMRT test at the 5% level.

Based on the results of the analysis of variance, the application of blotong compost had a significant effect on the height of groundnut plants (Table 1). At 14 days after sowing (DAS), plant height showed significant differences among treatments. The increase in plant height is thought to be related to early vegetative growth, particularly the process of cell division in the tissues. Cell elongation causes an increase in tissue size, resulting in an increase in plant height.

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The addition of blotong compost, which contains organic matter, is believed to improve soil conditions and the availability of nutrients required during this growth process. Research findings from (Elviani et al., 2022) indicate that the application of compost can enhance the height growth of groundnut plants. Kasmadi et al. (2020) also explain that the addition of organic matter can improve soil conditions and provide nutrients that support plant growth.

At 21 days after sowing (DAS), differences in plant height among treatments were again evident. The increase in plant height indicates that the processes of elongation and tissue development were still ongoing during the vegetative phase. At 28 days after sowing (DAS), differences in plant height among treatments remained evident, with higher compost doses tending to produce taller plants. This suggests that the addition of blotong compost supports sustained vegetative growth, allowing the processes of plant tissue formation and elongation to continue until 28 DAS.

Number of Leaves (pieces)

Table 2. Average Number of Leaves (pieces) on Peanut Plants

Treatment	14 DAP	21 DAP	28 DAP
Control	4.16 a	10.51 a	26.24 a
9 tons ha^{-1}	4.12 a	11.44 b	27.80 b
12 tons ha^{-1}	4.00 a	12.08 c	29.49 c
15 tons ha^{-1}	4.20 a	12.20 c	31.04 d
18 tons ha^{-1}	4.20 a	12.96 d	32.85 e

Note: Numbers followed by the same lowercase letter in the same column indicate no significant difference based on the DMRT test at the 5% level.

Based on the results of the analysis of variance, the application of blotong compost had a significant effect on the number of peanut leaves (Table 2). At 14 days after sowing (DAS), the number of leaves among treatments did not yet show a significant difference. This indicates that leaf formation in the early stages was still relatively uniform.

Differences in the number of leaves began to appear at 21 days after sowing (DAS) and became increasingly evident at 28 DAS. The increase in the number of leaves is thought to be related to the activity of the growing point in forming leaf primordia, which subsequently develop into leaves. The process of leaf formation requires cell division and development in meristematic tissue; thus, the better the growth of the growing point, the more leaves can be formed. The availability of nutrients and favorable growing conditions are believed to facilitate leaf formation and development. Rofikin et al. (2024) reported that the application of organic fertilizer can influence the number of leaves on peanut plants. Nurmi et al. (2024) also explained that the availability of nutrients supporting vegetative growth can promote leaf formation and canopy development. At 28 days after sowing, the number of leaves increased as the dose of blotong compost increased. This indicates that canopy development continues throughout the vegetative phase, as evidenced by the formation of new leaves at the growing points.

Stem Diameter (mm)

Table 3. Average Stem Diameter (mm) of Peanut Plants

Treatment	14 DAP	21 DAP	28 DAP
Control	0.236 a	0.396 a	0.540 a
9 tons ha^{-1}	0.276 a	0.444 b	0.624 b
12 tons ha^{-1}	0.312 c	0.436 bc	0.648 b
15 tons ha^{-1}	0.340 cd	0.468 c	0.688 c

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18 tons ha^{-1}	0.356 d	0.544 d	0.712 c

Note: Numbers followed by the same lowercase letter in the same column indicate no significant difference based on the DMRT test at the 5% level.

Based on the results of the analysis of variance, the application of blotong compost had a significant effect on the stem diameter of peanut plants (Table 3). At 14 days after sowing (DAS), stem diameter showed significant differences among treatments. The increase in stem diameter is believed to be related to cell division and enlargement, as well as the development of the tissues that make up the stem. These processes cause the stem to increase in size as the plant develops. Nutrient availability and favorable growing conditions are believed to support the formation and development of stem tissues.

At 21 days after sowing (DAS), stem diameter again showed significant differences among treatments. The increase in stem diameter indicates that stem tissue development continues throughout the vegetative phase. The addition of organic matter from blotong compost is believed to support soil conditions that promote plant growth. Fadila et al. (2024) reported that the application of organic fertilizer can affect the stem diameter of peanut plants. At 28 days after sowing (DAS), stem diameter again showed significant differences among treatments. However, the 15 and 18 ton ha^{-1} treatments yielded relatively similar values and were not significantly different. This suggests that increasing the blotong compost application rate within this range does not always result in a proportional increase in stem diameter.

Yield Component Variables

Table 4. Mean Pod Weight, Seed Weight, and Weight of 100 Seeds of Peanut Plants

Treatment	Pod Weight per Plant (g)	Seed Weight per Plant (g)	Weight of 100 Seeds (g)
Control	19.128 a	13.84 a	44.2 a
9 tons ha^{-1}	21.592 b	15.68 b	45.4 a
12 tons ha^{-1}	27.712 c	20.36 c	46.6 a
15 tons ha^{-1}	34.420 d	25.0 d	47.6 ab
18 tons ha^{-1}	41.332 e	30.56 e	50.4 b

Note: Numbers followed by the same lowercase letter in the same column indicate no significant difference based on the DMRT test at the 5% level.

Pod Weight per Plant

The application of blotong compost increased the pod weight per plant, with the highest yield observed at a rate of 18 tons ha^{-1}. This increase in pod weight is believed to be related to the processes of pod formation and development during the generative phase. Well-developed pods result in an increase in pod weight per plant. The blotong compost used contained 10.41% organic carbon with a C/N ratio of 14.3. The addition of this organic matter is believed to improve soil conditions and the root zone environment, thereby facilitating better root development as well as water and nutrient uptake during pod formation. These conditions, in turn, can support pod development and increase pod weight. These results are consistent with the study by Juniati et al. (2023), which reported that the application of agricultural waste compost can increase peanut yield components, including pod weight.

Seed Weight per Plant

The increase in seed weight with higher doses of blotong compost is thought to be related to seed development and dry matter accumulation during the seed-filling phase. Phosphorus plays a role in energy metabolism that supports seed growth and development, while potassium plays a role

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in regulating water balance and supports the translocation of photosynthetic products from the leaves to storage organs. The availability of these two elements can support seed filling, thereby potentially increasing the resulting seed weight. Additionally, the addition of blotong compost is believed to improve soil conditions and support nutrient availability during the generative phase. However, this relationship must be interpreted with caution because this study did not directly measure photosynthate translocation or plant nutrient uptake. These results are consistent with those of Nurcahya (2023), who reported that the application of organic waste compost together with N, P, and K fertilizers affects the yield components of groundnuts.

Weight of 100 Seeds

The weight of 100 seeds tended to increase with higher doses of blotong compost, but these increases were not all statistically significantly different from the control. Treatments at 9, 12, and 15 tons ha^{-1} were not significantly different from the control, whereas a significant difference was only observed at a dose of 18 tons ha^{-1}. This indicates that an increase in the mean seed weight does not necessarily reflect a significantly different response at every dose. The weight of 100 seeds is related to the size and dry matter accumulation of the seeds during their development. The application of compost is believed to support seed development; however, at doses of 9–15 tons ha^{-1}, this response did not result in a significant difference compared to the treatment without compost. These findings are consistent with those of Manao et al. (2025), who reported that the application of rice straw bokashi had no significant effect on the dry weight of 100 peanut seeds. These results reinforce the notion that the response of the weight of 100 seeds to the application of organic matter is not always significantly different and must be interpreted based on statistical test results.

Yield Variables

Table 5. Average Pod Weight per Plot of Peanut Plants

Treatment	Pod Weight per Plot (kg)
Control	1.20 a
9 tons ha^{-1}	1.48 b
12 tons ha^{-1}	1.49 b
15 tons ha^{-1}	1.49 b
18 tons ha^{-1}	1.53 b

Note: Numbers followed by the same lowercase letter in the same column indicate no significant difference based on the DMRT test at the 5% level.

Pod Weight per Plot

Pod weight per plot showed a difference between plants without compost application and those treated with blotong compost. The 9 tons ha^{-1} treatment already produced a higher pod weight per plot compared to the control, whereas increasing the dose to 18 tons ha^{-1} did not result in a significant difference. This pattern indicates that compost application is already capable of increasing yield at doses above 9 tons ha^{-1} , whereas further increases in dose do not result in significant differences.

Pod weight per plot is the cumulative pod weight of plants within a single experimental unit. The increase in yield at the plot level suggests that overall plant growth and pod formation were better under the compost treatment. The results of the study by Sopa et al. (2019) also indicate a response in pod weight per plot of groundnut plants to compost application, suggesting that the use of organic matter can be one approach to increasing crop yield at the plot level.

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Relationship Between Growth Components and Yield Components

Table 6. Pearson Product-Moment Correlation Coefficients between growth components and yield components of groundnut crops.

Variable Growth	Variable Yield	Correlation Coefficient (r)	Level Significance	Sig. (p)	Notes
Plant height at 28 days after sowing	Pod weight per plot	0.446	Moderate	0.025	Significantly positively correlated
Number of leaves at 28 days after sowing	Pod weight per plot	0.551	Moderate	0.004	Positive correlation significant
Stem diameter at 28 days after sowing	Pod weight per plot	0.366	Low	0.072	Positive but not significant correlation

Note: A p-value < 0.05 indicates a significant correlation.

The results of the Pearson correlation analysis showed that the relationship between growth components and pod weight per plot varied depending on the trait observed. The number of leaves at 28 days after sowing (DAS) had the strongest moderate positive correlation (r = 0.551), followed by plant height (r = 0.446). Both variables showed a significant relationship with pod weight per plot. Meanwhile, stem diameter had a lower positive correlation (r = 0.366), but it was not statistically significant. These results indicate that the number of leaves and plant height are more clearly associated with variations in pod weight per plot than stem diameter.

The stronger correlation with the number of leaves indicates that variations in leaf development are more closely related to pod weight per plot in this study. The number of leaves reflects canopy development, while plant height represents vertical growth. Although both are positively correlated with pod weight, the strength of the relationship is not the same. Yami et al. (2025) also reported a positive correlation between plant height and peanut seed yield (r = 0.58), thus supporting a link between growth traits and yield. However, these results do not imply that an increase in plant height or leaf number directly causes an increase in pod weight.

In contrast to these two traits, stem diameter did not show a significant relationship with pod weight per plot. This means that the variation in stem diameter at the observation stage was not statistically significant enough to be linked to variations in pod yield in this study. This difference underscores that not every growth trait has an equally strong relationship with yield. Overall, the number of leaves and plant height were significantly associated with pod weight per plot, whereas stem diameter did not show a significant relationship. Since this analysis is correlational, the results indicate an association among variables, not a cause-and-effect relationship.

Conclusion

The application of blotong compost affected the growth and several yield components of groundnuts (*Arachis hypogaea* L.). The 18 tons ha^{-1} rate produced the highest values for plant height, number of leaves, stem diameter, pod weight per plant, seed weight per plant, and weight of 100 seeds. Pod weight per plot at application rates of 9, 12, 15, and 18 tons ha^{-1} did not differ significantly. Plant height and number of leaves at 28 days after sowing showed a moderate and significant positive correlation with pod weight per plot, while stem diameter showed a low and insignificant positive correlation. Future research is recommended to test a wider range of blotong

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compost application rates within the 9–18 tons ha^{-1} range to obtain further information regarding efficient application rates based on peanut crop yields.

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