

THE EFFECT OF MASHITAM FERTILIZER AND COFFEE GROUNDS ON THE GROWTH AND YIELD OF GREEN OKRA PLANTS (*Abelmoschus esculentus* L.)

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Abstract: This research aims to determine the effect of mashitam fertilizer and coffee grounds, as well as the interaction between the two, on green okra plants. This study was conducted at the experimental garden of the Faculty of Agriculture at Abulyatama University in Bung Pageu Village, Blang Bintang District, Aceh Besar Regency, from November 2024 to February 2025. The design used in this study is a randomized block design with a 4×4 factorial pattern, consisting of 3 replications, which yields 16 treatment combinations and 48 experimental units. The first factor studied is mashitam fertilizer (M), consisting of 4 treatment levels: M₀ = control, M₁ = 1 g/polybag, M₂ = 2 g/polybag, and M₃ = 3 g/polybag. Meanwhile, the second factor studied is coffee grounds (K), which consists of 4 treatment levels: K₀ = control, K₁ = 2 g/polybag, K₂ = 4 g/polybag, and K₃ = 6 g/polybag. The research results show that the treatment with mashitam fertilizer has a very significant effect on the number of fruits per plant, the weight of fruits per plant, the length of fruits, and the diameter of fruits. The treatment with coffee grounds has a very significant interaction between mashitam fertilizer and coffee grounds. The best treatment is found in the combination of mashitam fertilizer and coffee grounds (M₃K₂), where mashitam fertilizer is used at 3 g/polybag and coffee grounds at 4 g/polybag.

Keywords: Mashitam Fertilizer, Coffee Grounds, Okra

1. Introduction

Okra plants (*Abelmoschus esculentus* L.) are a type of vegetable that belongs to the *Malvaceae* family and are originally from the tropical regions of Africa, first discovered in Abyssinia (now Ethiopia) and then spread to the various areas around the world, both in tropical and subtropical climates such as India, Japan, America, France, and Brazil (Barus et al., 2018). Okra fruit has high nutritional content, high in fiber, antioxidants, and vitamin C. It is commonly consumed as both a vegetable and a medicinal food due to its health benefits. Okra is technically a fruit that produces mucilage, a gel-like substance, which offers functional advantages. Per 100 g, okra contains 81.50 g water, 235.00 kJ (56.00 kcal) energy, 4.40 g protein, 0.60 g fat, 11.30 g carbohydrates, 2.10 g fiber, 532.00 mg calcium, 70.00 mg phosphorus, 0.70 mg iron, 59.00 mg vitamin C, 385.00 mg beta-carotene, 0.25 mg thiamine, 2.80 mg riboflavin, and 0.20 mg niacin (Yuliartini et al., 2018). Factors that influenced the cultivation of okra that are less than optimal include suboptimal cultivation techniques, the selection of okra varieties, poor seed quality, inadequate maintenance, pest and disease interference, excessive use of inorganic fertilizers, the use of chemical pesticides, and the lack of use of organic fertilizers (Raditya et al., 2017). One technique to solve this problem is by using organic fertilizers and coffee grounds. One of the organic fertilizers known in the market is Mashitam organic fertilizer. Mashitam is a compound N-P-K fertilizer in the form of solid black granules that contains complex organic materials known as humic acid (HA). The composition of Mashitam fertilizer includes Humic acid (10%), Nitrogen (10%), P₂O₅ (10%), K₂O (10%), and MgO (3%). After applying Mashitam organic fertilizer, it enhances the activity of soil microorganisms, such as bacteria and fungi, which then decompose the fertilizer

granules into nutrients ready to be absorbed by plant roots. Mashitam fertilizer has the advantage of being able to improve and maintain soil fertility, thus enabling sustainable agriculture, increasing the soils ability to retain water and maintain soil moisture, and possessing slow-release properties so that the availability of nutrients is distributed evenly over a planting period. The application of organic fertilizer from coffee grounds is the most effective alternative in crop cultivation because it contains the nutrients needed by plants. The advantage of coffee grounds is that it has a balanced macro nutrient content, such as nitrogen (N), phosphorus (P), and potassium (K). In addition, coffee grounds also contain other elements such as magnesium (Mg), copper (Cu), sulphur (S), and calcium (Ca), which positively impact the growth and development of plants (Wijaya, 2019). Based on the description above, it is not yet known for certain what doses of Mashitam fertilizer and Coffee Grounds are suitable for the growth and yield of green okra plants, so further research is needed on this matter.

2. Literature Review

2.1 Taxonomy of Okra Plants

The position of okra plants (*Abelmoschus esculentus* L) in the systematics (taxonomy) of plants according to (Idawati, 2012) is as follows:

Kingdom : *Plantae* (Plants)
 Division : *Magnoliophyta* (Flowering Plants)
 Class : *Magnoliopsida*
 Order : *Malvales*
 Family : *Malvaceae*
 Genus : *Abelmoschus*
 Species : *Abelmoschus esculentus* L

2.2 Morphology of Okra Plants

The root system of okra plants is classified as a taproot, which has fibrous roots. The penetration depth of the okra plant roots is relatively shallow at around 30-60 cm. Okra plants are sensitive to both water deficiency and excess, they require a lot of water but should not be waterlogged, especially during the flowering period (Rustam, 2019). (Ikrarwati, 2016) state that the okra plant has a hard, woody stem with few branches, and the buds in the leaf axils can grow into new branches. The stem of the okra plant stands upright and has a diameter of about 1.5-2 cm, and the height of the okra plant can reach 1-2 meters. The okra stem is reddish-green and is accompanied by fine to coarse hairs. According to (Idawati, 2012), the okra plant has broad, finger-like leaves with clearly visible veining from the underside of the leaf. The okra plant has long petioles, and the leaves are arranged alternately, with one leaf at each node. According to (Tyasningsiwi, 2023), the okra flower is trumpet-shaped, with a dark red interior, and has a short flower stalk of about 4-6 mm that is almost attached to the stem. (Gemede, 2015) state that okra plants have fruits shaped like a five-sided cone, with a fruit length of about 15-20 cm and a fruit stalk length of 2-3 cm, and a diameter of 1-5 cm. Okra fruits have five chambers that serve as seed compartments, with the seeds arranged longitudinally, and one chamber can contain 10-15 seeds.

2.3 Growth Requirements for Okra Plants

Okra does not require any special conditions for its growth, but for optimal growth and production, climate and soil factors are very important. Okra plants can be grown in various seasons because, in addition to being drought-resistant, okra is also tolerant of rainy season conditions as long as it is not flooded (Idawati, 2012). Okra growth requires temperatures above 20°C, with the optimal temperature for okra plant growth being 30°C, making this plant suitable for development in lowland areas (Prayudi et al., 2019). (Afandi, 2016) stated that okra plants can grow well in lowlands up to an altitude of less than 600 meters above sea level (masl). Okra plants do not require any specific type of soil for their growth process, but the soil factors still have an influence on the growth of healthy and optimal okra plants. According to (Prayudi et al., 2019), the type of soil suitable for okra plants is loose soil that can drain water, such as alluvial and latosol. Okra plants can also grow in sandy soil, but they require additional organic matter.

2.4 The Role of Mashitam Fertilizer Application on The Growth and Yield of Okra Plants

Fertilizations is one way to improve soil fertility through the provision of macro and micro nutrients needed by plants. Proper fertilization can provide optimal growth and maximize crop production. Mashitam Organic Fertilizer contains nutrient elements N10%, P10%, K 10%, HA 10%, and Mg 3% that are needed by plants. Thus, Mashitam Organic Fertilizer will increase the activity of soil microorganisms, which will then break down the granules of fertilizer into nutrients ready to be absorbed by plant roots (Soenyoto, 2016). Organic NPK fertilizer is a fertilizer that contains macronutrients that are generally needed by plants. Nitrogen in plants is a very important element for forming the proteins of the leaves and other compounds. In addition, it also plays a role in the vegetative development of plants, especially when the plants are still young. The research results of (Pujiastuti, n.d.) show that the application of Mashitam fertilizer at a dosage of 300 kg/Ha can improve the growth and yield of bean plants. The research results of (Soenyoto, 2016) show that the application of organic fertilizer Mashitam significantly affects the parameters of fruit weight, plant height, stem diameter, number of leaves, and number of fruits per plant, with a dosage of 250 kg/Ha on bitter melon.

2.5 The Role of Coffee Grounds in The Growth and Yield of Okra Plants

Coffee grounds are household waste typically found in cafes across various regions in Indonesia. Given the high interest in consuming coffee, yet coffee grounds are often discarded wastefully, they can be used as compost. The nutrient content in coffee grounds can serve as an alternative to meet the nutritional needs of plants. Coffee grounds contain 2.28% nitrogen, 0.06% phosphorus, and 0.6% potassium, with a pH level of 6.2. The nitrogen (N) element is essential for plants as it stimulates overall plant growth, phosphorus (P) plays a role in root growth stimulation, and potassium (K) is involved in the formation of proteins and carbohydrates (Wijaya, 2019). Coffee grounds can be utilized as organic fertilizer because they contain minerals and carbohydrates that help release nitrogen as a plant nutrient, and coffee grounds are acidic, which lowers the soil pH. Coffee grounds are an economical and environmentally friendly organic material. Coffee grounds can increase the intake of Nitrogen, Phosphorus, and Potassium needed by plants, thus fertilizing the soil and supporting the growth of cultivated plants (Teh et al., 2012). The research results of (Juliani, 2017) indicate that the application of coffee grounds at a dosage of 65 g/plant (2.6 tons/ha) has a significant effect on the height of the plants and the number of leaves of curly red chili plants. The research results of (Daulay, 2022) show that the application of coffee grounds has a very significant effect on several parameters, namely plant height (cm), number of leaves (strands), tuber

length (cm), tuber production per sample (g), and tuber production per plot (g), where the best treatment is K3 = 3 Kg/plot.

3. Method

This study was conducted at the experimental garden of the Faculty of Agriculture at Abulyatama University in Bung Pageu Village, Blang Bintang District, Aceh Besar Regency, from November 2024 to February 2025. The tools used in this study were a hoe, scissors, a watering can, a scale, a tarp, a bucket, a measuring tape, wood, rope, 10 kg polybags, stationery, and a camera for documentation. The materials used in this study were Naila IPB Green Okra seeds, Mashitam fertilizer, EM4, coffee grounds obtained from coffee shops around Aceh Besar, and soil from the research field.

This study used a factorial Randomized Block Design (RBD), consisting of two factors. The first factor was mashitam fertilizer (M), with four treatment levels. The second factor was coffee grounds (K), with four treatment levels. 16 experimental polybags were obtained which were repeated 3 times so that there were 48 experimental factors used were:

The first factor, the Mashitam Fertilizer dosage (M), was:

M0 = control

M1 = 1 g/polybag (200 kg/ha)

M2 = 2 g/polybag (400 kg/ha)

M3 = 3 g/polybag (600 kg/ha)

The second factor, the Coffee Grounds dosage (K), was:

K0 = control

K1 = 2 g/polybag (400 kg/ha)

K2 = 4 g/polybag (800 kg/ha)

K3 = 6 g/polybag (1200 kg/ha)

Observation data were analyzed using ANOVA. If a significant effect was found, further analysis was performed using the least significant difference test at a 5% probability level (LSD 0.05%) to compare the treatment averages.

4. Finding and Discussion

The Effect of Mashitam Fertilizer on The Growth and Yield of Plants

Plant Height (cm)

The average height of green okra plants at 14, 28, and 42 days after planting (DAP) as a result of various doses of mashitam fertilizer is presented in Table 1.

Table 1 . Average height of green okra plants at 14, 28, and 42 days after planting (DAP) due to various doses of mashitam fertilizer

Mashitam fertilizer dosage	Plant height		
	14 DAP	28 DAP	42 DAP
	(cm)		
M0 (Control)	12,79 a	22,46 a	45,46 a
M1 (1 g/polybag)	13,58 a	23,88 a	47,17 a
M2 (2 g/polybag)	14,29 b	25,08 b	48,88 b
M3 (3 g/polybag)	15,29 b	27,33 c	51,08 c
BNT 0.05	1,02	1,56	2,13
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.		

Table 1 shows that at 14 days after planting (HST), the tallest plants were found in the M3 treatment (3 g/polybag) with a value of 15.29, which was not significantly different from the M2 treatment (2 g/polybag), but significantly different from the other treatments. At 28 days after planting (DAP), the tallest plant was found in treatment M3 (3 g/polybag) with a value of 27.33, which was significantly different from all other treatments. At 42 days after planting (DAP), the tallest plant was found in treatment M3 (3 g/polybag) with a value of 51.08, which was significantly different from all other treatments. It is suspected that the application of mashitam fertilizer is capable of fulfilling the nutrient elements needed by plants during the growth phase. In the vegetative phase, plants require a high amount of nitrogen nutrients. One of the functions of nitrogen is to promote plant height growth. Mashitam fertilizer contains 10% nitrogen nutrients. This is in line with the research by (Soenyoto, 2016) that mashitam fertilizer contains nitrogen, phosphorus, potassium, and magnesium nutrients that are very much needed by plants.

Number of fruits per plant

The average number of fruit from green okra plants due to various doses of mashitam fertilizer is presented in Table 2.

Table 2 . Average number of fruits per plant green okra due to various doses of mashitam fertilizer

Mashitam fertilizer dosage	Number of fruits per plant
	(fruits)
M0 (Control)	4,58 a
M1 (1 g/polybag)	4,54 a
M2 (2 g/polybag)	4,42 a
M3 (3 g/polybag)	5,75 b
BNT 0.05	0,58
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.

Table 2 shows that the number of fruits per plant on green okra with the highest value is found in the mashitam fertilizer with a dosage of 3 g/polybag (M3), producing 5.75 fruits, which is significantly different from all other treatments. It is suspected that the applied black fertilizer can be absorbed by the green okra plants and provide sufficient nutrients needed, thus significantly increasing the number of fruits per plant. The black fertilizer contains

nutrient elements such as 10% phosphorus and 10% potassium, which play an active role in determining fruit formation. This is based on the function of the nutrient elements P and K, which are more effective in influencing carbohydrate and protein formation. Moreover, the nutrient elements potassium and phosphorus are also beneficial for flower formation, leading to a higher number of fruits produced.

Weight fruits per plant

The average weight fruits per plant from green okra plants due to various doses of mashitam fertilizer is presented in Table 3.

Table 3 . Average weight of fruits per plant green okra due to various doses of mashitam fertilizer

Mashitam fertilizer dosage	Weight of fruits per plant (gram)
M0 (Control)	72,50 a
M1 (1 g/polybag)	80,83 a
M2 (2 g/polybag)	79,17 a
M3 (3 g/polybag)	105,42 b
BNT 0.05	11,10
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.

Table 3 shows that the heaviest fruit weight of green okra plants was found in the treatment M3 (3 g/polybag) with a value of 105.42, which is significantly different from all other treatments. This is suspected to be due to the availability of nutrients in the mashitam fertilizer that can enhance the fruit weight parameter of green okra plants. In general, mashitam fertilizer has the advantage of improving the physical, chemical, and biological properties of the soil. This causes root growth to be maximized, allowing for effective water and nutrient absorption. In addition, potassium contained in black fertilizer is highly needed by plants during the generative phase. The nutrient K or potassium acts as an activator of various essential enzymes in the reactions of photosynthesis and respiration, as well as enzymes involved in the synthesis of starch and protein.

The Effect of Coffee Grounds on The Growth and Yield of Plants Plant Height (cm)

The average height of green okra plants at 14, 28, and 42 days after planting (DAP) as a result of various doses of coffee grounds is presented in Table 4.

Table 4 . Average height of green okra plants at 14, 28, and 42 days after planting (DAP) due to various doses of coffee grounds

Coffee grounds dosage	Plant height		
	14 DAP	28 DAP	42 DAP
	(cm)		
K0 (Control)	13,67	24,21	47,13
K1 (2 g/polybag)	13,58	23,88	47,92
K2 (4 g/polybag)	14,38	25,25	49,00
K3 (6 g/polybag)	14,33	25,38	48,54
BNT 0.05	-	-	-
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.		

Table 4 shows that at 14 days after planting (HST), the highest plant height tends to be in the K2 treatment (4 g/polybag) with a value of 14.38 cm. At 28 days after planting (HST), the highest plant height tends to be in the K3 treatment (6 g/polybag) with a value of 25.38 cm. At 42 days after planting (HST), the highest plant height tends to be in the K2 treatment (4 g/polybag) with a value of 49.00 cm. It is suspected that the level of coffee grounds application was too low for the needs of the green okra plants, thus it did not have a significant effect on the height of the green okra plants. Coffee grounds contain 2.28% nitrogen, 0.06% phosphorus, and 0.6% potassium. Fertilization must be provided at adequate levels and doses to obtain a significant effect.

Number of fruits per plant

The average number of fruit from green okra plants due to various doses of coffee grounds is presented in Table 5.

Table 5 . Average number of fruits per plant green okra due to various doses of coffee grounds

Coffee grounds dosage	Number of fruits per plant (fruits)
K0 (Control)	4,00 a
K1 (2 g/polybag)	4,58 a
K2 (4 g/polybag)	4,83 b
K3 (6 g/polybag)	5,88 c
BNT 0.05	0,58
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.

Table 5 shows that the highest number of fruit plants is found in the treatment K3 (6 g/polybag) with a value of 5.88, which is significantly different from all other treatments. It is suspected that coffee grounds have a significant effect on the parameter of the number of fruit plants. Coffee grounds contain nitrogen, phosphorus, potassium, magnesium, sulfur, and calcium. The phosphorus and potassium elements in coffee grounds are crucial for plants during fruit ripening and formation. The phosphorus content in coffee grounds is beneficial for stimulating flowering and fruiting.

Weight fruits per plant

The average weight fruits per plant from green okra plants due to various doses of coffee grounds is presented in Table 6.

Table 6 . Average weight of fruits per plant green okra due to various doses of coffee grounds

Coffee grounds dosage	Weight of fruits per plant (gram)
K0 (Control)	65,42 a
K1 (2 g/polybag)	80,83 b
K2 (4 g/polybag)	87,92 b
K3 (6 g/polybag)	103,75 c
BNT 0.05	11,10
Description :	The numbers followed by the same letter in the same column do not differ significantly in the 5% BNT test.

Table 6 shows that the heaviest fruit weight of green okra plants was found in the treatment K3 (6 g/polybag) with a value of 103.75, which is significantly different from all other treatments. It is suspected that the applied coffee grounds can be absorbed by the green okra plants and provide sufficient nutrients, thereby significantly increasing the fruit weight of

the green okra plants. The potassium content during the fruiting period can serve as an enzyme cofactor, thus stimulating fruit formation.

5. Conclusion and Recommendation

The application of mashitam fertilizer has a very significant effect on the observations of plant height (14, 28, and 42 days after planting), the number of fruits per plant, and the weight of fruits per plant. The application of coffee grounds has a very significant effect on the observation of the number of fruits per plant and the weight of the fruits per plant.

Further research is needed on the use of mashitam fertilizer and coffee grounds using different commodities, with a dose of 3 grams of mashitam fertilizer per polybag and 4 grams of coffee grounds per polybag.

Reference

- Afandi, A. L. (2016). Pengaruh pemberian dosis pupuk urea pada beberapa galur terhadap pertumbuhan, hasil, dan kualitas okra (*Abelmoschus esculentus*). *Skripsi. Program Studi Agroteknologi Fakultas Pertanian Universitas Jember*.
- Barus, ria anindi antika, Hanum, C., & Sipayung, R. (2018). respons pertumbuhan dan produksi dua varietas okra (*abelmoschus esculentus* L. Moench) terhadap pemberian berbagai jenis pupuk organik. *Agroekoteknologi Fp Usu*, 6(2), 253–258. <https://doi.org/https://doi.org/10.32734/ja.v6i2.2602>
- Daulay, G. amanda. (2022). Pertumbuhan dan produksi lobak (*Rahanus sativus* L.) terhadap pemberian kompos ampas kopi dan POC urine kuda. *Fakultas Sains Dan Teknologi Universitas Pembangunan Panca Budi Medan*.
- Gemedede, H. F. (2015). Nutritional Quality and Health Benefits of Okra (*Abelmoschus esculentus*): A Review. *Journal of Food Processing & Technology*, 06(06). <https://doi.org/10.4172/2157-7110.1000458>
- Idawati, N. (2012). Peluang Besar Budidaya Okra. *Agro Media Pustaka. Yogyakarta*.
- Ikrarwati, R. N. A. (2016). Budidaya Okra dan Kelor Dalam Pot. *Jakarta (ID): Balai Pengkajian Teknologi Pertanian (BPTP)*.
- Juliani, V. (2017). Pengaruh Pemberian Ampas Kopi terhadap Pertumbuhan Tanaman Cabai Merah Keriting (*Cupslcum annum* var. Langun L.) dan Pengajarannya di SMA Negeri 5 Palembang. *Skripsi. Universitas Muhammadiyah Palembang*.
- Prayudi, M. S., Barus, A., & Sipayung, R. (2019). Respons Pertumbuhan dan Produksi Tanaman Okra (*Abelmoschus esculantus* L. Moench) terhadap Waktu Pemangkasan Pucuk dan Pemberian Pupuk NPK The Response Growth and Production of Okra (*Abelmoschus esculantus* L. Moench) upon the Pruning Time of Shoots and NPK. *Januari*, 7(1), 72–80. <https://jurnal.usu.ac.id/agroekoteknologi72>
- Pujiastuti, S. R. (n.d.). *Efisiensi Pemupukan NPK dan Pupuk Kandang terhadap Produksi dan Viabilitas Benih Buncis (Phaseolus vulgaris L.)*.
- Raditya, J., Purbajanti, E. D., & Slamet, W. (2017). *Pertumbuhan dan produksi okra (Abelmoschus esculentus L.) pada level pemupukan dan jarak tanam yang berbeda*. Fakultas Peternakan Dan Pertanian Undip.
- Rustam, M. (2019). Pengaruh Kotoran Burung Walet dan Pupuk Majemuk 15: 15: 15 terhadap Pertumbuhan dan Produksi Tanaman Okra (*Abelmoschus esculentus* L.). *Skripsi. Fakultas Pertanian Universitas Muhammadiyah Sumatera Utara. Medan*.
- Soenyoto, E. (2016). PENGARUH DOSIS PUPUK ANORGANIK NPK MUTIARA (16:16:16) DAN PUPUK ORGANIK MASHITAM TERHADAP PERTUMBUHAN

- DAN PRODUKSI TANAMAN BAWANG MERAH (*Allium ascalonicum* L.) VARIETAS BANGKOK THAILAND. *Hijau Cendekia*, 1(1), 21–27. <http://fp.uniska-kediri.ac.id/ejournal>
- Teh, P. A., Kopi, A., Penambah, S., & Adikasari, R. (2012). *Pemanfaatan Ampas Teh dan Ampas Kopi Sebagai Penambah... (Ria Adikasari)* 0. 0–11.
- Tyasningsiwi, R. W. (2023). Okra si Lady's Finger Hortikultura. *Direktorat Perlindungan Hortikultura*.
- Wijaya, P. P. A. K. (2019). Perbedaan Kualitas Kompos Limbah Ampas Kopi dengan Penambahan Bioaktivator EM4 dan MOL Nasi Basi. *E-Conversion - Proposal for a Cluster of Excellence*, 1–54.
- Yuliartini, M. S., Sudewa, K. A., Kartini, L., & Praing, E. R. (2018). Peningkatan Hasil Tanaman Okra Dengan Pemberian Pupuk Kompos dan NPK. *Gema Agro*, 23(1), 11. <https://doi.org/10.22225/ga.23.1.653.11-17>