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Effect of Growing Media Composition and Potassium Fertilizer Dosage on the Growth and Yield of Tomato (*Lycopersicum esculentum* L.)

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ABSTRACT

The market demand increase in tomato has not been matched by the tomato production. One of the factors of tomato plant production is less than optimal due to lack of potassium nutrition and improper planting media, causing flower loss. The aim of this current study is to evaluate the effect of planting media composition and the dose of KCl fertilizer on the growth and yield of tomato plants. The research was conducted in Jemur Wonosari, Wonocolo District, Surabaya City, East Java, from November 2023 to February 2024. The experiment was designed according to a Completely Randomized Design with two factors, each consisting of 4 levels, and was executed in triplicates. The composition of planting media was the first factor at different ratio of S:GM:RHC with S =soil, RHC = rice husk charcoal, and GM = goat manure. There were 4 media compositions, namely M0 (1:0:0), M1 (1:1:1), M2 (1:1:2), and M3 (1:2:1). The dosage of KCl fertilizer (K) was the second factor, included K0 = 150 kg/ha, K1 = 150 kg/ha, K2 = 200 kg/ha, and K3 = 250 kg/ha. The results showed that the treatment combination of planting media composition M1 (1:1:1) + KCl dose 150 kg/ha was able to accelerate the flowering time of tomato plants.

1. INTRODUCTION

Tomatoes are one of the most important vegetable crops in Indonesia. This horticultural crop has a high nutritional content and apart from being a significant source of domestic consumption, tomatoes are also an export commodity, both as fresh and processed vegetables (Kusuma & Zuhro, 2015). Market demand for tomatoes continues to increase every year, driven by the development of various industries, which increases the need for tomatoes. Based on data from the BPS (2022), tomato production in 2019 reached 74,558 tons, increasing to 83,920 tons in 2020, 93,121 tons in 2021, and 102,099 tons in 2022. This increase was caused by high market demand which was in line with population growth and increasing public awareness of healthy lifestyles (Wadu, 2023). An increase in tomato production occurs in the dry season, while in the rainy season tomato production tends to be lower. Therefore, it is necessary to increase tomato production, especially during the rainy season (Wulandari, 2024).

One of the main reasons causing a decrease in tomato production is flower loss or flower drop. According to Pardal *et al*. (2016), in his research the number of fruits per plant produced by tomato plants was 38–65% lower than the number of flowers formed. This can be caused by several factors such as a deficiency of one of the important nutrients, namely potassium. Lack of potassium in plants can cause symptoms such as weak plant growth, flower drop, decreased fruit quality, small fruit size, and necrosis of old leaves (Ambarwati *et al*., 2020). It is important to ensure tomato plants receive an adequate supply of potassium to prevent excessive flower drop.

It is compulsory to modify the composition of the planting media correctly so that potassium fertilizer can be absorbed optimally by the roots. Planting media must have characteristics such as good drainage, ability to hold water,

adequate cation exchange capacity, free from harmful microorganisms, and contain organic materials (Damanik & Setyorini, 2021). Using a planting medium consisting of a mixture of soil, husk charcoal and goat manure can be an alternative for increasing soil fertility. According to Widodo & Kusuma (2018), added organic material can improve the physical quality of the soil by reducing unit weight, increasing aggregate stability, soil porosity and water capacity. Apart from that, the addition of husk charcoal helps optimal plant root growth. According to Segari at al. (2017), the use of husk charcoal media improve the properties of soil, both physically, chemically and biologically. In particular, the porous physical nature of the media means that the roots can develop optimally so that they can reach all parts of the media to get the nutrients they need. The absorbed elements are used as material for photosynthesis which will produce photosynthates which is used to form more seedlings. Based on the description above, this research aims to evaluate the effect of the combination of planting media composition and treatment doses of potassium fertilizer on the growth and yield of tomato plants.

2. MATERIALS AND METHODS

This research took place from November 2023 to February 2024 in Jemur Wonosari, Wonocolo District, Surabaya City, East Java.

2.1. Materials and Tools

The tools used in this research were shovels, gembors, stakes, raffia rope, measuring cups, rulers, calipers, scissors, ovens, analytical scales. The materials used in this research include servo variety tomato seeds, NPK fertilizer (Mutiara 16:16:16), KCl fertilizer (Mahkota), soil, goat manure, husk charcoal, compost, pesticides, 40×40 cm polybags, stakes or ramps, labels, water, insecticide and fungicide.

2.2. Research Method

This research was structured in a factorial completely randomized design. The first factor was composition of the planting media (M) notated as the ratio of soil (S), rice husk charcoal (RSC), and goat manure (GM). The growing media consisted of 4 compositions based on the ratio of (S:GM:RSC), namely M0 (1:0:0), M1 (1:1:1), M2 (1:1:2), and M3 (1:2:1). The dose of KCl fertilizer (K) was the second factor consisted of 4 treatment rates, namely K0 = 150 kg/ha, K1 = 150 kg/ha, K2 = 200 kg/ha, and K3 = 250 kg/ha. There were 16 combination treatments, each was executed in triplicates, resulted in 48 experimental units. Each treatment contained 2 plant samples so that the plant population was 96 plants.

Observations of tomato plant growth parameters were carried out in the vegetative and generative phases. Vegetative observations were carried out at 14, 28, 42, 56, 70 days after planting (DAT), including plant length and number of leaves. Generative observations include the age at which flowers emerge (DAP), the number of flowers (flowers), the number of fruit, the fruit weight. The data obtained will be analyzed using Analysis of Variance (ANOVA) followed by Honestly Significant Difference (HSD) test at $\alpha = 5\%$.

3. RESULTS AND DISCUSSION

3.1. Plant Length

The results of ANOVA on various treatment combinations of planting media composition and potassium fertilizer dosage did not have a significant impact on plant length. Meanwhile, the single factor of planting media treatment showed a significant influence on plant length at the age of 14-42 days after planting. Treatment M1 at a ratio of soil, husk charcoal, and goat manure (1:1:1) had a significantly different effect from treatment M0 but was not significantly different from treatments M2 and M3. Meanwhile, for the treatments, the potassium fertilizer doses of 0 kg/ha, 150 kg/ha, 200 kg/ha, and 250 kg/ha did not differ significantly in tomato plant length.

The planting media treatment showed a real influence on plant length because the composition of the planting media M1 (1:1:1) at that age provided the most optimal amount of nutrients needed by plants to support plant length growth. A balanced planting media composition can encourage optimal vegetative growth of plants, one of which is

plant length. The existence of husk charcoal in the planting medium make the medium have a light and porous structure, thereby helping to increase air circulation and water drainage around the roots. According to Anjarwati *et al.* (2017), adding husk charcoal is an effective planting medium in absorbing nutrients. The nutrients in this media are carried through water which is absorbed by plant roots through the diffusion process of osmosis. The more nutrients that can be absorbed by plants, the better the availability of the main ingredients for the photosynthesis process. The results of photosynthesis will later be used to increase the length of plant internodes. Agustin *et al*. (2014), also stated that the development of the root system affects the overall growth and development of the plant. The average length of tomato plants influenced by the composition of the planting media is presented in Table 1.

Table 1. Effect of planting media composition on the plant length of tomato plants at age 14-42 DAP

Treatment	Tomato Plant Length (cm)		
	14 DAP	28 DAP	42 DAP
M0 = Soil (Control)	17.65 [a]	35.78 [a]	53.25 [a]
M1 = Soil + Manure + Husk (1:1:1)	22.02 [b]	47.78 [b]	62.31 [b]
M2 = Soil + Manure + Husk (1:1:2)	20.75 [ab]	47.61 [b]	59.47 [ab]
M3 = Soil + Manure + Husk (1:2:1)	18.50 [ab]	42.44 [b]	57.04 [ab]
HSD 5%	3.34	6	6.36

Note: Different superscripts following mean values in the same column indicate significant based on HSD test at α = 5%; tn = not significant.

3.2. Number of Leaves

Analysis of variance showed that the interaction o the composition of the planting medium and the dosage of potassium fertilizer had no significant impact on the leaf number parameters. However, a single factor planting media composition had a significant impact on the number of leaves at 14 to 28 DAP. This is because potassium is more optimal in the generative phase of plants. Uliyah *et al*. (2017), the element potassium can help plants speed up the photosynthesis process so that it stimulates more assimilate produced by plants, thereby helping speed up the vegetative phase of plants and entering the generative phase. The average number of tomato leaves influenced by the planting media composition is presented in Table 2.

The M1 planting media composition treatment, namely a mixture of soil, husks, manure with a ratio of (1:1:1) produced the highest number of leaves at 14 days after and 28 days after planting. The M1 treatment had a significant impact from the M0 treatment but was not significantly different from the M2 and M3 treatments at the ages of 14 DAP and 28 DAP. This is due to the balanced planting media composition, with the addition of husk charcoal and manure which is able to optimize plant vegetative growth, especially the number of leaves. The addition of goat manure to the planting medium provides important nutrients, especially nitrogen, which is needed for vegetative growth. In accordance with research by Ihsan (2014), increasing the use of manure in planting media will increase nitrogen levels. Nitrogen is an important element that influences plant vegetative growth, characterized by an increase in cell size, plant length and length, as well as the development of new leaves and branches. In the vegetative phase, nitrogen plays an essential role in the process of cell division, which is part of plant metabolism. At plant length of 42-70 DAP there is no real effect because there are factors that influence the number of leaves, namely the presence of child leaves appearing and the shedding of old leaves. Old leaves fall and seedlings that emerge die, so the overall number of leaves decreases.

Table 2. Effect of planting media compositions on the number of leaves of tomato plants at age 14 and 38 DAP

Treatment	Number of Leaves (sheets)	
	14 DAP	28 DAP
M0 = Soil (Control)	6.67 [a]	10.96 [a]
M1 = Soil + Manure + Husk (1:1:1)	8.08 [b]	12.29 [b]
M2 = Soil + Manure + Husk (1:1:2)	7.83 [b]	12.25 [b]
M3 = Soil + Manure + Husk (1:2:1)	7.25 [ab]	12.04 [b]
HSD 5%	0.8	0.98

Note: Different superscripts following mean values in the same column indicate significant based on HSD test at α = 5%; tn = not significant.

3.3. Flowering Time

According to the results of the analysis of the influence of the planting media composition and the dose of potassium fertilizer, it shows a real interaction on the age at which the flowers appear on tomato plants. Both the planting media composition and the dose of potassium fertilizer have a significant influence on the age at which the flowers appear on tomato plants. The average age at which flowers appear on tomato plants depending on the planting media composition and the dose of potassium fertilizer is detailed in Table 3.

The combination treatment of the K1M1 planting media composition, namely planting media composition with a ratio of soil : manure : charcoal (1:1:1) with a KCl dosage of 150 kg/ha, produces a faster average age for flower emergence on tomato plants. The K1M1 treatment produces an average of the average age at which flowers appeared was faster (24.00 DAP) compared to the K3M0 treatment (33.67 DAP) which had a difference of 9 days. Providing the right composition of planting media and dosage of potassium fertilizer can cause the flowering age of tomato plants to appear faster. Based on existing data, M1 treatment supports good root system growth because the addition of husk charcoal makes the roots easy in absorbing the potassium nutrient provided through fertilization. According to Kusuma (2013), the addition of charcoal or husk ash creates space that allows roots to grow through it, so that the roots can absorb nutrients in greater quantities. Optimal absorption of nutrients in plants causes the dose of potassium fertilizer given to accelerate flowering in tomato plants. This is in line with Rosyidah (2016), the speed of flowering occurs because of the role of potassium as a metabolic activator and as a transporter of metabolic products so that the flowering process becomes faster.

Table 3. Effect of combination treatments on the time at which first flower appear (DAP) on tomato plants

Treatment	**Flower Appearance Age (DAP)**			
Fertilizer Dosage KCl	**M0 (1:0:0)**	**M1 (1:1:1)**	**M2 (1:1:2)**	**M3 (1:2:1)**
K0 = 0 (Control)	28.50 ^{abc}	27.17 ^{abc}	30.33 ^{abc}	31.83 ^{bc}
K1 = 150 kg/ha	31.83 ^{bc}	24.00 ^{a}	27.33 ^{abc}	31.17 ^{bc}
K2 = 200 kg/ha	30.33 ^{abc}	26.17 ^{ab}	26.67 ^{abc}	26.83 ^{abc}
K3 = 250 kg/ha	33.67 ^{c}	30.17 ^{abc}	27.67 ^{abc}	29.50 ^{abc}
HSD 5%		7.15		

Note: Different superscripts following mean values indicate significant based on HSD test at α = 5%.

Table 4. Effect of treatment on the number of flower of tomato plants

Treatment Planting Media Composition	**Interest Amount (interest)**
M0 = Soil (Control)	53.25 ^{a}
M1 = Soil + Manure + Husk (1:1:1)	59.71 ^{b}
M2 = Soil + Manure + Husk (1:1:2)	56.63 ^{ab}
M3 = Soil + Manure + Husk (1:2:1)	56.17 ^{ab}
HSD 5%	3.76
KCl Fertilizer Dosage	
K0 = 0 (Control)	55.21
K1 = 150 kg/ha	57.08
K2 = 200 kg/ha	57.63
K3 = 250 kg/ha	55.83
HSD 5%	tn

Note: Different superscripts following mean values in the same column and the same treatment indicate significant based on HSD test at α = 5%; tn = not significant.

3.4. Number of Flowers

Average number of flowers on tomato plants by the influence of planting media composition and potassium fertilizer dosage is presented in Table 4. The results of the analysis of various treatments, the composition of planting media, had a significant influence on the number of flowers. Treatment M1, namely the planting media composition with a mixture of soil, manure, husk charcoal with a ratio of (1:1:1) alone, produced an average number of flowers per plant,

namely 59.71 flowers and was significantly higher than that of planting media composition M0, although not significantly different from those of M2 and M3 treatments.

The planting media composition M1 produced the highest average number of flowers compared to the M0 (only soil) treatment. The planting media prepared with right composition can produce more flowers than the control treatment, namely soil. The results of this research show that providing the composition in the right ratio can increase the number of flowers produced. There needs to be the right media conditions so that the absorption of nutrients through the roots runs optimally. Agustin *et al*. (2014) also stated that the development of the root system affects the overall growth and development of the plant. Therefore, the right planting media composition is needed to support good root system growth, so that plants can grow and develop optimally. In the generative phase, the results of photosynthesis will be translocated to form flowers and fruit.

3.5. Number of Fruits per Plant

The average fruit number of tomato plants depending on the composition of the planting media and the dose of potassium fertilizer is detailed in Table 5. Results of ANOVA showed that the composition of the planting medium and the dose of potassium fertilizer had a significant influence on the number of fruits per plant. The planting media composition M1 (1:1:1) had a higher average fruit number of tomato plants compared to the M0 planting media composition treatment. Damanik & Setyorini (2021) found that planting media composition consisting of soil, manure and husk charcoal (1:1:1) generally gives the best results for tomato plants. The composition of the planting media has better drainage, thanks to the addition of organic materials such as manure and husk charcoal. Meanwhile, the treatment with a dose of potassium fertilizer (K2) of 200 kg/ha produced an average fruit number of tomato plants that was higher and significantly higher from those of other treatments.

This is because the role of potassium also helps in preventing flower loss and improving fruit quality as well as increasing photosynthate movement, development of fruit size and quality. Andini *et al*. (2021), adequate nutrient content, especially potassium, is one of the factors that supports fruit formation. The average value of the number of fruits per tomato plant in the potassium fertilizer dose treatment was carried out by correlation regression analysis which is presented in Figure 1. The results of the regression curve shows coefficient of determination (R^2) of 0.1056. This value indicates that the increase in the number of tomato fruit is slightly affected (10.56%) by the KCl dose, while the remaining 89.44% is influenced by other factors. The graph shows a positive line, which means there is a relationship between the increase in the number of fruit per plant and the dose of KCl fertilizer. Based on this, the number of fruit per plant formed is in line with the increase in the dose of fertilizer given per plant, this shows that the dose of potassium fertilizer given has a positive effect on the number of total fruit produced per plant. Amisnaipa *et al*. (2009), increasing the provision of KCl will have an impact on increasing plant length and harvest fruit weight linearly. The higher the potassium (K) nutrient content in the soil, the more the plant's need for K elements will be met, which ultimately results in more optimal tomato growth.

Table 5. Effect of treatment on the number of fruits of tomato plants

Treatment Planting Media Composition	Number of Fruits per plant
M0 = Soil (Control)	22.67 [a]
M1 = Soil + Manure + Husk (1:1:1)	25.46 [b]
M2 = Soil + Manure + Husk (1:1:2)	24.54 [b]
M3 = Soil + Manure + Husk (1:2:1)	24.00 [ab]
HSD 5%	1.85
Potassium Fertilizer Dosage	
K0 = 0 (Control)	23.04 [a]
K1 = 150 kg/ha	23.79 [a]
K2 = 200 kg/ha	26.46 [b]
K3 = 250 kg/ha	23.38 [a]
HSD 5%	1.85

Note: Different superscripts following mean values in the same column and the same treatment indicate significant based on HSD test at α = 5%; tn = not significant.

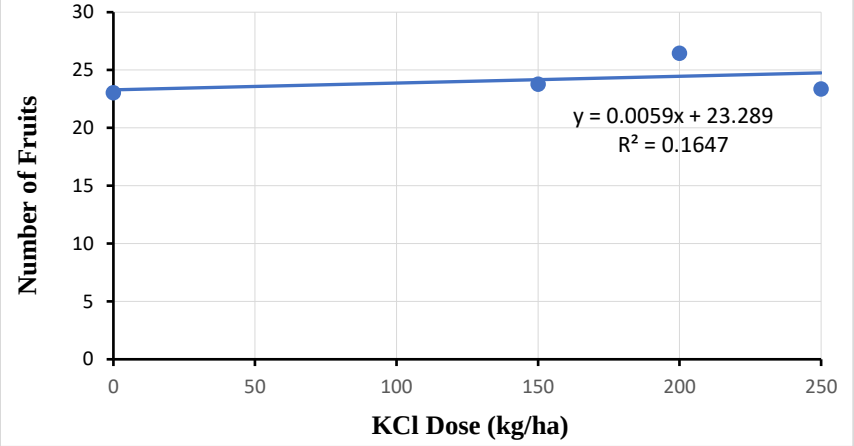

Figure 1. Regression analysis of the number of fruits treated with potassium fertilizer doses

Based on the provision of potassium fertilizer at a dose of 250 kg/ha, this has decreased because excessive fertilizer can cause plants to become poisoned. The balance of fertilizer use must be considered because continuous K fertilization causes an imbalance in soil nutrients. High K nutrient levels cause pressure on the availability of micro nutrients such as Zn and Cu (Saidi, 2017). This is in accordance with research conducted by Hutapea (2013), increasing the dose to 250 kg/ha did not show a significant difference compared to giving a dose of 175 kg ha^{-1}. This is in line with Utomo *et al*. (2016) based on Liebig's Minimum Law, which states that plant growth will be limited by the nutrients whose presence is relatively few.

3.6. Fruit Weight

The results of the analysis of variations in single factor planting media composition and the dose of potassium fertilizer alone had a significant impact on the number of fruits per tomato. The average fruit weight of tomato plants influenced by the planting media composition and the dose of potassium fertilizer is given in Table 6. The planting media composition M1 (1:1:1) had a higher average fruit weight parameter for tomato plants and was significantly higher than that of M0 (1:0:0) treatment. This is because the low production of tomatoes is influenced by the nutrients available in the planting medium. Excessive use of compost in the planting media can cause damage to cells and tissues in the plant body. Likewise, too little compost or immature compost result in difficulties for the plants to absorb nutrients optimally so their growth will be hampered (Marviana & Utami, 2014). Meanwhile, treatment with KCl fertilizer dose of 200 kg/ha (K2) alone resulted in a higher average fruit weight of tomato plants and was significantly different from the potassium fertilizer doses K0, K1, and K3.

Table 6. Effect of treatment on the fruit weight (g/plant) of tomato plants

Treatment Planting Media Composition	Fruit Weight (g/plant))
M0 = Soil (Control)	606.46 [a]
M1 = Soil + Manure + Husk (1:1:1)	698.59 [b]
M2 = Soil + Manure + Husk (1:1:2)	694.23 [b]
M3 = Soil + Manure + Husk (1:2:1)	655.90 [ab]
HSD 5%	60.22
Potassium Fertilizer Dosage	
K0 = 0 (Control)	635.32 [a]
K1 = 150 kg/ha	657.14 [a]
K2 = 200 kg/ha	724.89 [b]
K3 = 250 kg/ha	637.83 [a]
HSD 5%	60.22

Note: Different superscripts following mean values in the same column and the same treatment indicate significant based on HSD test at α = 5%; tn = not significant.

Providing potassium during fruit formation can maximize high potassium levels in the fruit and minimize fruit damage. Providing K fertilizer will increase the weight of the harvested fruit. Sari *et al*. (2022), the translocation of photosynthate to the fruit of tomato plants is clearly influenced by potassium, where potassium increases the movement of photosynthate out of the leaves towards the roots, and this will increase the energy supply for root growth, size development and fruit quality so that fruit weight increases. The relation of fruit weight per plant and KCl fertilizer dose treatment is presented in Figure 2.

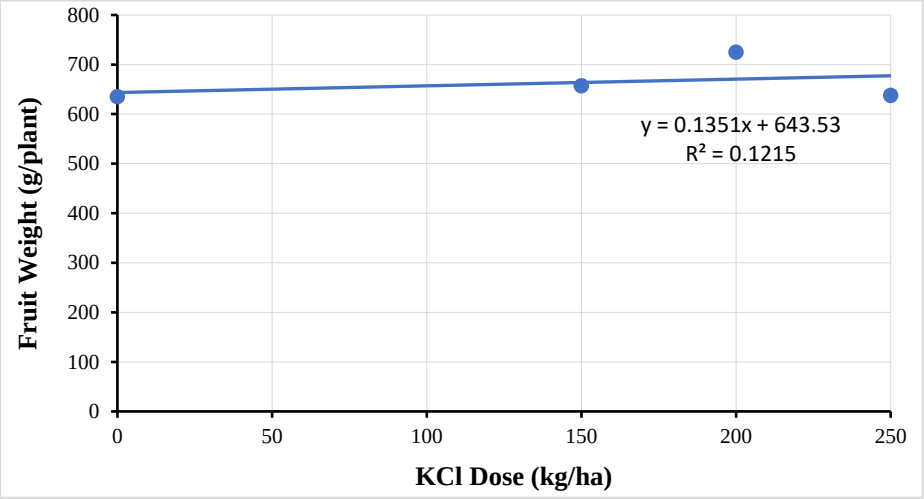

Figure 2. Regression analysis of fruit weight treatment with potassium fertilizer doses

Figure 2 shows the results of the regression analysis of fruit weight of tomato plants based on the dose of KCl fertilizer. When related to the relationship between tomato plant growth as measured by fruit weight and the dose of KCl fertilizer, it can be seen that the effect of KCl dose on fruit weight is linear. If seen from the regression relationship and correlation between the two, increasing the dose of potassium fertilizer causes a mior increase in fruit weight with (R^2 = 0.1215). This figure shows that the increase in plant fruit weight was affected by the amount of potassium fertilizer by 12.15%. Based on the linear equation, the regression coefficient obtained is 0.14, which means that every increase in the dose of potassium fertilizer results in an increase of fruit weight per plant by 0.14 g. Assadiyah *et al*. (2023) states that sufficient potassium (K) element in plants plays an important role in increasing the number of harvested fruit, which contributes to increasing overall yield.

Potassium treatment at a dose of 250 kg/ha results in a decrease in the growth and yield of tomato plants because excessive KCl fertilizer can cause plants to experience potassium poisoning, which can interfere with the absorption of other important nutrients, resulting in plants experiencing symptoms of nutritional deficiency. This is in accordance with Jamilah's (2015) research, that excessive provision of one nutrient will suppress the availability of other elements in plants, due to unbalanced fertilization. Griffith (2015), added that if excess K is absorbed by plants, it will suppress the availability of Mg in plants or vice versa.

4. CONCLUSION

From this research we can conclude that planting media composition and the dose of KCl fertilizer have a significant impact on the growth and yield of tomato plants. Using the composition of planting media comprised of soil, goat manure, and husk charcoal at a weight ratio of (1:1:1) produces the best results in the parameters of plant length, number of leaves, number of flowers, number of fruit, weight of single fruit, and fruit weight per plant. Application of 200 kg/ha of potassium fertilizer provides the best results in the number of fruit (26.46 per plant) during the harvest period, and fruit weight (724.89 g/plant).

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REFERENCES

Agustin, D.A., Riniarti, M., & Duryat. (2014). Pemanfaatan limbah serbuk gergaji dan arang sekam sebagai media sapih untuk cempaka kuning (*Michelia champaca*). *Jurnal Sylva Lestari,* ***2***(3), 49-58. https://doi.org/10.23960/jsl3249-58

Ambarwati, D.T., Syuriani, E.E., & Pradana, O.C. (2020). Uji respon dosis pupuk kalium terhadap tiga galur tanaman tomat (*Lycopersicum esculentum* Mill.) di lahan Politeknik Negeri Lampung. *Planta Simbiosa*, ***2***(1). https://doi.org/10.25181/jplantasimbiosa.v2i1.1608

Amisnaipa., Susila, A.D., Situmorang, R., & Purnomo, W. (2009). Penentuan kebutuhan pupuk kalium untuk budidaya tomat menggunakan irigasi tetes dan mulsa polyethilene. *Jurnal Agronomi Indonesia,* ***37***(2), 115-122.

Andini, R.P., Asra, R., & Adriadi, A. (2021). Pemanfaatan limbah kulit buah kakao terhadap pertumbuhan tanaman tomat (*Lycopersicon esculentum* Mill.). *Agrovigor: Jurnal Agroekoteknologi*, ***14***(2), 116–122. https://doi.org/10.21107/agrovigor.v14i2.10205

Anjarwati, H., Waluyo, S., & Purwanti, S. (2017). Pengaruh macam media dan takaran pupuk kandang kambing terhadap pertumbuhan dan hasil sawi hijau (*Brassica rapa* L.). *Vegetalika*. ***6***(1), 35–45. https://doi.org/10.22146/veg.25983

Assadiyah, A.N., Dewanti, F.D., & Sulistyono, A. (2023). Respon hasil tanaman tomat (*Solanum lycopersicum* L.) terhadap macam media tanam dan konsentrasi pupuk organik cair limbah kulit buah. *Agro Bali: Agricultural Journal*, ***6***(1), 93-104.

BPS (Badan Pusat Statistik). (2022). *Produksi Tanaman Sayur 2022*. Badan Pusat Statistik, Jakarta.

Damanik, A.F., & Setyorini, T. (2021). Respon pertumbuhan dan hasil produksi tanaman tomat varietas fortuna dengan perlakuan kombinasi pupuk tunggal pada komposisi media tanam berbeda. *Vegetalika*, ***10***(4), 247-258.

Hutapea, A.S. (2013). Pengaruh pemberian pupuk kalium (KNO_3) terhadap infeksi tobacco mosaik virus (TMV) pada beberapa variets tembakau virginia (*Nicotiana tabacum* L.). [*Undergraduate Thesis*], Brawijaya University.

Ihsan, T.T.R.M. (2014). Kajian perbanyakan vegetatif tanaman binahong (*Anredera cordifolia* (Ten) Steenis) pada beberapa media tanam. *Jurnal Agronomika*, ***9***(02), 179-190. https://journal.uniba.ac.id/index.php/AGR/article/view/69

Jamilah, J., Ernita, M., & Ahmad, R. (2020). Penggunaan pupuk cair *Chromolaena odorata* dan kalium dalam menekan kehampaan dan meningkatkan hasil padi ungu black madras. *Agronida*, ***6***(1), 55-63. https://doi.org/10.30997/jag.v6i1.2382

Kusuma, A.H., Izzati, M., & Saptiningsih, E. (2014). Pengaruh penambahan arang dan abu sekam dengan proporsi yang berbeda terhadap permeabilitas dan porositas tanah liat serta pertumbuhan kacang hijau (*Vigna radiata* L). *Buletin Anatomi dan Fisiologi*, ***21***(1), 1-9. https://doi.org/10.14710/baf.v21i1.6260

Marviana, D.D., & Utami, L.B. (2014). Respon pertumbuhan tanaman terung (*Solanum melongena* L.) terhadap pemberian kompos berbahan dasar tongkol jagung dan kotoran kambing sebagai materi pembelajaran biologi versi kurikulum 2013. *Journal JUPEMASI-PBIO,* ***1***(1), 161-166.

Pardal, S.J., Purnamaningsih, R., Lestari, E.G., & Slamet, N. (2016). Phenotypic analysis on progenies of three transgenic parthenocarpy tomato lines in biosafety containment. *Journal Hortikultura*, ***26***(1), 21-30.

Rosyidah, A. (2016). Respon pemberian pupuk kalium terhadap ketahanan penyakit layu bakteri dan karakter agronomi pada tomat (*Solanum lycopersicum* L.). *Prosiding Seminar Nasional Hasil Penelitian Unikama*: 147-152.

Saidi, B.B (2017). Status hara lahan sawah danrekomendasi pemupukanpadi sawahpasang surut di Kecamatan Rantau Rasau Kabupaten Tanjung Jabung Timur Jambi. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, ***1***(2), 121-129. https://doi.org/10.22437/jiituj.v1i2.4274

Sari, G.L.M., Pertami, R.R.D., & Eliyatiningsih, E. (2022). Aplikasi pupuk kalium terhadap pertumbuhan dan produksi tanaman cabai merah besar (*Capsicum annuum* L.). *Agropross: National Conference Proceedings of Agriculture*, ***6***, 221–233. https://doi.org/10.25047/agropross.2022.292

Segari, A., Rianto, H., & Susilowati, Y.E. (2017). Pengaruh macam media dan dosis urin kelinci terhadap hasil tanaman seledri (*Apium graveolens* L.). *VIGOR: Jurnal Ilmu Pertanian Tropika dan Subtropika*, ***2***(1), 1-4.

Uliyah, V.N., Nugroho, A., & Suminarti, N.E. (2017). Kajian variasi jarak tanam dan pemupupuk kandang kalium pada pertumbuhan dan hasil tanaman jagung manis (*Zea mays saccharata* Sturt L.). *Journal Produksi Tanaman*, ***5***(12), 2017-2025.

Utomo, M., Sudarsono, S., Rusman, B., Sabrina, T., Lumbanraja, J., & Wawan, W. (2016). *Dasar-Dasar Ilmu Tanah dan Pengelolaan*. Pranadamedia Group, Jakarta.

Wadu, J. (2023). Faktor-faktor yang mempengaruhi produksi tomat di Kelurahan Kawangu Kecamatan Pandawai Kabupaten Sumba Timur. *Jurnal Rekayasa dan Manajemen Agroindustri*, ***11***, 126-132.

Widodo, K.H., & Kusuma, Z. (2018). Effects of compost on soul physical properties and growth of maize on an inceptisol. *Jurnal Tanah Sumberdaya Lahan,* ***5***(2), 959-967.

Wulandari, L., & Jaya, I.K.D. (2024). Pengaruh pupuk kalium yang berbeda terhadap pertumbuhan dan hasil dua varietas tanaman tomat (*Lycopersicum esculentum* Mill.) di luar musim. *Jurnal Ilmiah Mahasiswa Agrokomplek*, ***3***(3), 177-185.