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Effect of Liquid Organic Fertilizer (POC) Concentration and Biodive Fertilizer on the Growth and Yield of Purple Eggplant Plants (*Solanum melongena L.*)

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Abstract

Background: Purple eggplant is a vegetable commodity that many like because of its delicious taste and good nutrition for health. The demand for purple eggplant increases significantly every year but is not matched by an increase in production due to poor cultivation, one of which is less than optimal fertilization. Increasing production can be achieved through several efforts, including organic fertilization. This research aims to determine the optimal combination and concentration of each treatment for applying liquid organic fertilizer (POC) and Biodive fertilizer, which best affects the growth and yield of purple eggplant plants. **Method:** This research used a Completely Randomized Design (CRD) consisting of 2 factors. The first factor is the POC (N) concentration, which is divided into three levels composed of concentrations of 0 ml/l (N0), four ml/l (N1), and eight ml/l (N2). The second factor is the concentration of Biodive Fertilizer (P), which is divided into four levels consisting of concentrations of 0 ml/l (P0), 10 ml/l (P1), 20 ml/l (P2), and 30 ml/l (P3). **Results:** The results showed that treatment with a concentration of 8 ml/l POC and 30 ml/l Biodive Fertilizer increased the number of leaves, number of flowers, number of fruit, and total fresh weight of fruit per plant. **Conclusion:** This research can conclude that treatment with a concentration of 8 ml/l POC and 30 ml/l Biodive Fertilizer has the best effect on purple eggplant plants.

Keywords: eggplant; biodive fertilizer concentration; poc concentration

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Introduction

Eggplant (*Solanum melongena L.*) is a horticultural plant that is very popular and liked by many people because of its taste and nutritional content, such as vitamin A and phosphorus (P), which are suitable for health. Every 100 g of eggplant contains 26 calories, 1 g protein, 0.2 g carbohydrates, 25 UI vitamin A, 0.04 g vitamin B, and 5 g vitamin C, as well as bioactive compounds such as alkaloids, solanine and solasodine (Sunarjono, 2013).

In the last two years, eggplant production in Indonesia has increased slightly, from 676,339 tons to 691,738 tons during 2021-2022. Meanwhile, data on eggplant consumption in Indonesia increased from 2,605 kg/capita to 2,885 kg/capita in 2021 - 2022 (BPS, 2022). This shows that demand for eggplant continues to increase but is not matched by increased production due to poor cultivation, such as suboptimal fertilization. Therefore, increasing eggplant production continues to be carried out through optimizing fertilizer application, one of which is through efforts to use organic fertilizer to reduce chemical fertilizers to increase harvest yields (Ahmad, 2011). Iswati (2012), in previous research, proved that the

higher the application of organic fertilizer, the better the growth response and results shown by the plants.

POC is fertilizer composed of the remains of living things, such as manure, plant remains, urine, and animal and human waste. Organic fertilizer can be in solid or liquid form, affecting the soil's physical, chemical, and biological properties. POC is a solution that results from the decomposing of organic materials from plant residues, animals, and human waste, whose nutrient content exceeds one element (Alex, 2015). The advantages of POC are that it can quickly overcome nutrient deficiencies, has no problems in leaching nutrients, and can provide nutrients rapidly. POC generally does not damage soil and plants, even if used as often as possible. This solution also has a binder so that the fertilizer solution applied to the soil surface can be used directly by plants. The research results of Fitra et al. (2014) showed that giving POC with the highest concentration increased the weight and number of chili fruits compared to the control. Similar results were demonstrated in Ahmad et al. (2017) research, which shows that giving POC can increase the height, fruit weight, and number of eggplant fruits per plant.

Providing Biodive fertilizers is one way to increase plant growth that is more environmentally friendly in organic cultivation. Biodive fertilizers contain bacteria such as PGPR (Plant Growth Promoting Rhizobacteria). PGPR is a group of bacteria that colonize and live around plant roots. It is beneficial because it can increase plant growth. The function of PGPR contained in Biodive Fertilizers in improving plant growth is divided into three categories, namely: (1) as a plant growth promoter/stimulator by synthesizing and regulating the concentration of various growth regulators (ZPT) such as IAA, Gibberellin, Cytokinin and Ethylene in the environment. Root; (2) as a nutrient provider by symbiotically fixing N2 from the air and dissolving P nutrients bound in the soil; (3) as a control agent for pathogens originating from the soil by producing various compounds such as siderophore, β-1,3-glucanase, chitinase, antibiotics, and cyanide (Yolanda et al., 2011). Applying Biodive Fertilizer with the highest concentration on cayenne pepper plants can increase plant height, fruit number, and weight (Ayun et al., 2013). Therefore, this research aims to determine the effect of various POC and Biodive fertilizer concentrations on the growth and yield of purple eggplant (*Solanum melongena L.*).

Methods

This research was carried out on Jl. Made, Sambikerep District, Surabaya City, East Java. The implementation time is March-July 2023. The tools used in this research include plastic seedlings, seedbed trays, polybags (40 x 40 cm), stakes, spatulas, hoes, knives, rulers, scissors, solution meters, digital scales, measuring cups, calipers, hand sprayer stationery, gloves, camera, and computer. The materials used include Antaboga variety eggplant seeds, husks, compost, adhesive, POC, Biodive fertilizers, labels, and insecticides.

This research was designed as a factorial experiment with two factors arranged using a Completely Randomized Design (CRD). The first factor is the concentration of POC 'NASA' (N), which consists of 3 treatment levels. The second factor is the FloraOne (P) biofertilizer concentration, which consists of 4 levels. The treatment of these two factors obtained 12 treatment combinations repeated three times, so 36 experimental units were obtained. Three plant samples represented each experimental unit, so 108 plants were observed.

Observation parameters included plant height, number of leaves, stem diameter, root wet weight, age at flower emergence, total number of flowers per plant, the total number of fruit per plant, total fresh weight per plant, fruit diameter, fruit length, and fruit set. Data were analyzed using ANOVA analysis of variance. If the treatment had a significant effect or the calculated F value was greater than the F table value at the 5% significance level, further testing was carried out using the 5% Honestly Significant Difference (BNJ) test.

Result

The analysis results on the number of leaves parameter indicated a real interaction in the combined treatment of POC concentration and Biodive Fertilizer on the growth of the number of leaves of purple eggplant plants aged 35 HST. The average value of the number of leaves of purple eggplant plants due to the influence of the combined treatment of POC concentration with Biodive Fertilizer is presented in Table 1.

Table 1. Average Number of Leaves of Purple Eggplant Plants at the Combination of POC Concentration and Biodive Fertilizer at 35 HST

Treatment	Biodive Fertilizer Concentration (ml/l)			
POC concentration (ml/l)	0 (P_0)	10 (P_1)	20 (P_2)	30 (P_3)
0 (N0)	12,33^{b}	10,22^{a}	13,44^{c}	13,44^{c}
4 (N1)	12,11^{b}	10,00^{a}	12,22^{b}	12,44^{b}
8 (N2)	12,44^{b}	12,00^{b}	12,56^{b}	14,44^{d}
BNJ 5%		0,86		

Note: Numbers followed by the same letter indicate that they are not significantly different in the 5% BNJ test.

Table 1 shows that combining a POC concentration of 8 ml/l with a Biodive Fertilizer of 30 ml/l (N2P3) produced the highest number of leaves at 35 HST and significantly differed from other treatment combinations. There was an increase in the number of leaves due to the combined effect of N2P3 treatment by 17.11% compared to the control (N0P0).

The number of flower parameters analysis indicated a significant interaction in the combined POC concentration and Biodive Fertilizer treatment on the total number of purple eggplant plants. The average value of the total number of flowers per purple eggplant plant due to the influence of the combined treatment of POC concentration with Biodive Fertilizer is presented in Table 2.

Table 2 shows that the eight ml/l POC concentration combination with 30 ml/l Biodive Fertilizer (N2P3) produces the most flowers and significantly differs from other treatment combinations. There was an increase in the number of flowers due to the combined effect of N2P3 treatment by 36.71% compared to the control (N0P0).

Table 2. Average Total Flower Number of Purple Eggplant Plants in the Combination of POC and Biodive Fertilizer Concentrations

Treatment	Biodive Fertilizer Concentration (ml/l)			
POC concentration (ml/l)	0 (P0)	10 (P1)	20 (P2)	30 (P3)
0 (N0)	9,67^{ab}	10,11^{b}	10,00^{ab}	10,00^{ab}
4 (N1)	9,00^{a}	11,56^{cd}	9,44^{ab}	10,44^{abc}
8 (N2)	10,56^{bc}	9,56^{ab}	12,56^{de}	13,22^{e}
BNJ 5%		1,44		

Note: Numbers followed by the same letter indicate that they are not significantly different in the 5% BNJ test.

The analysis results on the number of fruit parameters indicated a significant interaction in the combined POC concentration and Biodive Fertilizer treatment on the total number of purple eggplant plants in fruit. The average value of the total number of fruits per purple eggplant plant due to the influence of the combined treatment of POC concentration with Biodive Fertilizer is presented in Table 3.

Table 3. Average Total Number of Fruits per Purple Eggplant Plant in the Combination of POC and Biodive Fertilizer Concentrations

Treatment	Biodive Fertilizer Concentration (ml/l)			
POC Contentration (ml/l)	0 (P0)	10 (P1)	20 (P2)	30 (P3)
0 (N0)	6,44[a]	7,11 [ab]	7,00[ab]	7,56[abc]
4 (N1)	6,56[ab]	8,56[cd]	7,33[ab]	7,67[abc]
8 (N2)	7,56[abc]	7,22[ab]	9,56[de]	10,22[e]
BNJ 5%		1,18		

Note: Numbers followed by the same letter indicate that they are not significantly different in the 5% BNJ test.

Table 3. shows that combining a POC concentration of 8 ml/l with a Biodive Fertilizer of 30 ml/l (N2P3) produces the highest number of fruits per plant and significantly differs from other treatment combinations. There was an increase in the number of flowers due to the combined effect of N2P3 treatment by 58.7% compared to the control (N0P0). The analysis results on the total fresh weight parameter indicated that each treatment of POC concentration and Biodive Fertilizer had an authentic influence on the total fresh weight of fruit per purple eggplant plant. The average value of the total fresh weight of fruit per purple eggplant plant due to the impact of the combined treatment of POC concentration with Biodive Fertilizer is presented in Table 4.

The addition of fresh fruit weight per plant in the POC concentration treatment can be seen in Figure 1. The best total fresh fruit weight per plant is shown by the POC concentration treatment of 8 ml/l, followed by the POC concentration treatment of 4 ml/l and POC 0 ml/l. The addition of fresh fruit weight per plant in the Biodive Fertilizer concentration treatment can be seen in Figure 1. The best total fresh fruit weight per plant is shown by the Biodive Fertilizer concentration treatment of 30 ml/l, followed by 20 ml.

Table 4. Average Total Fresh Fruit Weight per Eggplant Plant in Each Treatment of POC Concentration and Biodive Fertilizer

Treatment	**Total Fruit Fresh Weight (g)**
POC Concentration (ml/l)	
0 (N0)	701,51[a]
4 (N1)	727,89[a]
8 (N2)	783,38[b]
BNJ 5 %	35,22
Biodive Fertilizer Concentration (ml/l)	
0 (P0)	693,81[a]
10 (P1)	719,46[b]
20 (P2)	741,38[c]
30 (P3)	795,72[d]
BNJ 5%	16,39

Note: Numbers followed by the same letters in the same treatment are not significantly different in the 5% BNJ test.

Table 4. shows that a POC concentration of 8 ml/l and Biodive Fertilizer of 30 ml/l (N2P3) each produced the highest total fresh weight of fruit per plant and was significantly different from other treatment combinations. There was an increase in the number of flowers due to the influence of the eight ml/l POC treatment and 30 ml/l Biodive Fertilizer by 11.7% and 14.7% compared to the control of each treatment.

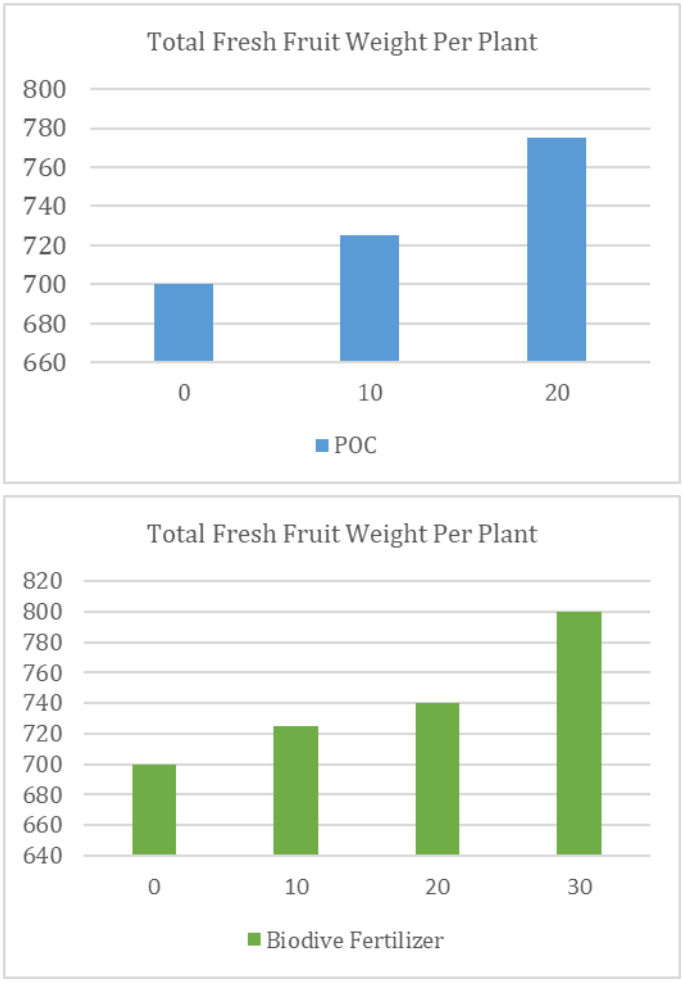

Figure 1. Histogram of Total Fresh Fruit Weight per Plant by the Effect of POC Concentration and Biofertilizer

Discussion

The best treatment combination for the growth and yield of purple eggplant plants was shown by treatment with a POC concentration of 8 ml/l and a Biodive Fertilizer of 30 ml/l. This is because these two concentrations can meet the needs of the macro and micronutrients contained therein. The POC used contains complete nutrients, both macro and micro. At the same time, the Biodive Fertilizer includes a consortium of Plant Promoting Rhizobacter (PGPR) bacteria, which helps provide nutrients through symbiotic or non-symbiotic mechanisms, such as dissolving or fixing nutrients so that they are available for plants to use during the vegetative or generative period.

Providing POC with a higher concentration can guarantee a more optimal supply of nutrient needs, one of which is the supply of N, which plays an essential role during the vegetative phase of plants. The increase in the number of leaves shown in the results is the effect of the nitrogen element, which is needed to accelerate plant growth, as a form of chlorophyll which is used to speed up the rate of photosynthesis so that more food reserves are produced to ensure the "sink" of flowers and fruit can be fulfilled. Optimally sufficient N elements can accelerate the growth and formation of new organs in the vegetative phase of purple eggplant plants. The element N is a nutrient that plays a role in forming plant vegetative organs and is the main element that forms amino acids and proteins (Arista et al., 2015). The elements N, P, and K contained in the POC solution with a concentration of 8 ml/l can have a better influence on the parameters of the number of leaves, flowers, fruit, and fresh weight of fruit per purple eggplant plant, thereby providing better growth and yield. also when compared to other treatment levels. The elements P and K play an essential role in plant development when they enter the generative phase, especially in

accelerating the formation and ripening of flowers and fruit. The P element functions to help form several specific proteins to accelerate the flowering and ripening of seeds and fruit. In contrast, the K element plays a role in strengthening the plant body so that the leaves, flowers, and fruit do not fall easily. This follows the statement of Nurmala (2023), who explains that the high number of fruit and fruit weight is due to the elements P and K being available in optimum and balanced amounts for the plant.

Concentrated treatment of Biodive Fertilizer is suitable for combination with POC because the PGPR can help supply nutrients available in the soil and are absorbed by plant roots. This is shown by the increased results due to the influence of this combination. The Biodive Fertilizer contains several active bacteria, such as *Pseudomonas fluorescent*, Azospirillum sp., and Rhizobium sp., which help plant nutrient absorption. A greater concentration of Biodive Fertilizer means providing a more significant number of bacterial colonies in the soil when compared to a lower concentration. The more bacterial colonies contained in the soil, the greater the nutrient content so that it is available in the soil and can be absorbed by the roots of the eggplant plant. The bacteria in Biodive Fertilizer can help roots maximize the absorption of nutrients in the soil. Putrie (2016) stated that Biodive fertilizers could colonize plant roots, affecting the extension of plant roots so that nutrient absorption is better.

The higher the concentration of Biodive Fertilizer applied, the more bacteria contained in each 1 ml of the solution (biofertilizer + water). The more bacteria contained in the applied fertilizer solution, the more opportunities the bacteria have to be able to colonize around the roots (rhizosphere) through symbiotic and non-symbiotic mechanisms so that they can expand the root uptake area and increase the N, P, and K elements available in the soil that has been applied and anchored by the bacteria to be absorbed by the roots. This is under the statement of Nazimah et al. (2020), whose research explains that the application of Biodive Fertilizer at the highest dose is considered to provide a more significant number of bacteria and is better able to provide the nutrients needed by plants so that it has the best effect on growth and the yield of tomato plants when compared to other applications of smaller doses. The highest results on the generative parameters of the number of flowers, total number of fruit, and total fresh weight of fruit per plant due to the application of 30 ml/l Biodive Fertilizer were influenced by the content of organic N, P, and K elements that were available due to N fixation by *Pseudomonas* sp bacteria. as well as the dissolution of P and K elements by bacterial colonies such as Rhizobium, Azotobacter and Pseudomonas contained in this concentration can better meet plant needs compared to other treatment levels. The high number and weight of fruit are influenced by the ability of P and K solubilizing bacteria (BPF and BPK), which can help provide P and K elements that can be absorbed by the roots in sufficient quantities so that they can maintain the existence of flowers until they become fruit so that they can increase yields in the form of quantity and quality—total fruit weight per plant.

Adequate phosphate needs can increase growth and improve root structure as the foundation of plant life so that nutrient absorption becomes more optimal during the growth process and the formation of other purple eggplant plant organs in each growth phase. This is the opinion of Siregar et al. (2015), stating that the element P can stimulate root growth, producing lots of root hair, thereby increasing the wet and dry weight of the roots. Good root structure and optimal number of leaves also increase the results obtained. This is because the P element has a role in influencing the formation of new cells in plant tissue, thus triggering the formation and development of plant organs. According to Rahmawati et al. (2018), the height and number of plant leaves are influenced by the nutrient factor P, and phosphate is needed by plants for the formation of new cells in growing tissue, thus triggering the formation of new leaves and strengthening the stem for primary (vertical) growth.

The potassium element can increase production and facilitate assimilating distribution so that plant food reserves increase and their development is maximized to increase food storage capacity. The more assimilated stored, the faster the plant will grow.

The number of fruits is related to forming of flowers into fruit on the plant. The number of flowers affects the fruit set percentage because if many flowers appear but abort, the number of flowers that become fruit will be low. Flower abortion in research was caused by several factors, such as environmental conditions (wind) and nutrient availability. The nutrient that plays a role in reducing flower loss is potassium (K). This is the opinion of Kurniawati et al. (2015) that the K element strengthens plant bodies such as leaves, flowers, and fruit so they do not fall easily. According to Prasetyo (2014), flower formation and fruit filling are greatly influenced by the nutrients N, P, and K, which will be used in the photosynthesis process by the leaves, namely as constituents of carbohydrates, fats, proteins, minerals, and vitamins which will be translocated to the storage part of the fruit According to Sanjaya et al. (2021), the element potassium (K) functions to transport and assimilate, act as a catalyst in protein formation, increase carbohydrate and sugar levels in fruit, make plant seeds fuller and denser, improve fruit quality such as shape and size. Better color.

Conclusions

The treatment with a POC concentration of 8 ml/l and Biodive Fertilizer of 30 ml/l was the best concentration for the parameters of the number of leaves, number of flowers, total number of fruit, total fresh weight of fruit per purple eggplant plant (*Solanum melongena L.*).

Declaration statement

The authors reported no potential conflict of interest.

References

Ahmad, F. (2011). Pengaruh Interaksi Hara Nitrogen dan Fosfor terhadap Pertumbuhan Tanaman Jagung (*Zea mays* L.) pada Tanah Regosol dan Latosol. *J. FMIPA*, 10 (3) : 10-19. http://dx.doi.org/10.14203/beritabiologi.v10i3.744

Al Ahmad, A. M., P.S. Utomo, dan A.D. Rosanti. (2017). Pengaruh Dosis Cam puran Pupuk Kandang dan Campuran POC BMW Terhadap Pertumbuhan dan Produksi Tanaman Terung Pondoh (*Solanum melongena L.*) Varietas Butho. *Hijau Cendikia*, 2(2): 35-40.

Alex, S. (2015). *Sukses Mengolah Sampah Organik Menjadi Pupuk Organik.* Pustaka Baru Press. Yogyakarta. 163 Halaman.

Arista, D., Suryono dan Sudadi. (2015). Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Afrisol. *Agrosains*, 17(2): 49-52. https://doi.org/10.20961/agsjpa.v17i2.18672

Ayun, K. Q., T. Hadiastono, dan M. Martosudiro (2013). Pengaruh Penggunaan PGPR (*Plant Growth Promoting Rhizobacteria*) terhadap Intensitas TMV (*Tobacco Mosaic* Virus), Pertumbuhan, dan Produksi pada Tanaman Cabai Rawit (*Capsicum frutescens* L.). *Jurnal Hama* dan *Penyakit Tumbuhan*, 1(1), 47.

Badan Pusat Statistik (BPS). (2023). *Produksi Tanaman Sayuran 2022.* https://www.bps.go.id/id/statistics-table/2/NjEjMg==/produksi-tanaman-sayuran.html (Diakses pada 25 Februari 2024).

Iswati, R. (2012). Pengaruh Dosis Formula PGPR (*Plant Growth Promoting Rhizobacteria*) Asal Perakaran Bambu terhadap Pertumbuhan Tanaman Tomat (*Solanum lycopersicum* syn). *Jurnal Agroteknotropika*, 1(1): 9-12.

Kurniawati, Y., A. Karyanto., dan Rugayah. (2015). Pengaruh Pemberian POC dan Dosis Pupuk NPK (15:15:15) terhadap Pertumbuhan dan Produksi Tanaman Mentimun (*Cucumis sativus* L.). *J. Agrotek Tropika,* 3 (1): 30-35. http://dx.doi.org/10.23960/jat.v3i1.1894

Nurmala, A. (2023). Pengaruh Konsentrasi ZPT Hormonik dan Dosis Pupuk NPK Phonska Plus terhadap Pertumbuhan dan Hasil Tanaman Tomat (*Lycopersicum esculentum* Mill.) *Skripsi*. UPN "Veteran" Jawa Timur.

Nazimah, Nilahayati, Safrizal dan A. Jeffri. (2020). Respon Pemberian Pupuk Hayati terhadap Pertumbuhan dan Hasil Produksi Dua Varietas Tanaman Tomat (*Lycopersicum esculentum* Mill.). *Jurnal Agrilum*, 17(1): 67-73. https://doi.org/10.29103/agrium.v17i1.2357

Prasetyo, R. (2014). Pemanfaatan Berbagai Sumber Pupuk Kandang sebagai Sumber N dalam Budidaya Cabai Merah (*Capsicum annum* L.) di Tanah Berpasir. *Planta Tropika Journal of Agro Science*, 2 (2): 126-132. https://doi.org/10.18196/pt.2014.032.125-132

Putrie R. F. W. (2016). *Plant Groeth Promoting Rhizobacter* (PGPR) Penghasil Eksopolisakarida Sebagai Inokulan Area Pertanian Lahan Kering. Bogor: LIPI. 7 Pages.

Rahmawati, I. D., K. I. Purwani, Anton Muhibbudin. (2018). Pengaruh Konsentrasi Pupuk P terhadap Tinggi dan Panjang Akar *Tagetes erecta* L. (Marigold) Terinfeksi Mikoriza yang Ditanam Secara Hidroponik. *Jurnal Sains* dan *Seni ITS*, 7(2): 2337-3520. http://dx.doi.org/10.12962/j23373520.v7i2.37048

Sanjaya, P., N. Kurnia, K. Hendarto dan F. Yelli. (2021). Pengaruh Pupuk Kandang dan Pupuk Hayati pada Pertumbuhan dan Produksi Tanaman Tomat (*Lycopersicum esculentum* Mill.). *Jurnal Agrotek Tropika*, 9(1): 171-176. http://dx.doi.org/10.23960/jat.v9i1.4895

Siregar, I., D. I. Roslim dan Herman. (2015). Respons Panjang dan Volume Akar Seledri (*Apium graveolens* L. var. secalinum) terhadap Kompos Pelepah Kelapa Sawit dan Pupuk Kotoran Kerbau. *JOM FMIPA* 2(2): 1-7.

Sunarjono. (2013). *Bertanam 30 Jenis Sayuran.* Penebar Swadaya. Jakarta. 183 Halaman.

Yolanda, E. M. G., D. J. Hernandez, M. A. M. Esparza, M. B. Cristales, L. F. Ramirez, R. D. M. Contreras and J. M. Rojas. (2011). Growth Response of Maize Plantlets Inoculated with *Enterobacter* spp., as a Model for Alternative Agriculture. *Revista Argentina de Microbiologia*. 4(3): 287-293.). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Confirmation_bias&oldid=949571730