Effect of Bamboo (*Bambusa sp*) Shoot Liquid Organic Fertilizer On Growth of Pre-Anthesis Cayenne Pepper (*Capsicum frutescens* L.) By Hydroponics

Dwijowati Asih Saputri[1*], Marlina Kamelia[2], Nurhaida Widiani[3], Ari Hermawan[4]

[1234] Department of Biology Education, Faculty of Education and Teacher Training, Islamic State University Raden Intan Lampung, Indonesia

** email: dwijowatiasihsaputri@radenintan.ac.id*

Article Info

Key word:
Bamboo shoot
Cayenne pepper
Hydroponic
Pre-synthesis
Fertilizer

Article history:
Received: 18/03/2020
Revised: 05/11/2020
Accepted: 25/11/2020

ABSTRACT

An environmentally-friendly agricultural system with organic fertilizer is used to reduce the use of chemical fertilizers, thus producing healthy agricultural products for consumption. Liquid organic fertilizer from bamboo shoots is an alternative substitute for chemical fertilizers in the planting of cayenne pepper (Capsicum frutescens L.*) hydroponically. This study aims to determine the effect of bamboo shoot liquid organic fertilizer on hydroponic cayenne pepper pre-antithesis growth. The study was conducted at the Biology Laboratory of UIN Raden Intan Lampung, using a Completely Randomized Design (CRD) with 6 treatments with 3 replications. The treatments included negative control (water), positive control (AB mix), P1 = 10%, P2 = 15%, P3 = 20%, P4 = 25% ml. The parameters include plant height, number of leaves, stem diameter, plant fresh weight. Data were analyzed using One Way Anova, followed by LSD at the 5% level. The results show the effect of treatment on all parameters. Control positive (AB mix) gave the best results on all parameters, then successively treated P4, P3, P2, P1, K0 (negative control). Although not as good as using an AB mix solution, the administration of bamboo shoots POC with a concentration of 25% can support the growth of hydroponic cayenne pre-synthesis.*

Introduction

Cayenne pepper (*Capsicum frutescens* L.) is a plant that is well known by the people of Indonesia, in addition to its distinctive taste, this plant has high nutritional value, especially sources of minerals, carbohydrates, protein, calcium and vitamins that are good for the body (Alfi, 2017). Indonesian people and most of the inhabitants of the Asian continent use cayenne pepper as a spice in cooking.

The uptake of the cayenne commodity market continues to increase in line with an increase in population (Ama Kii, 2018). Data from the Central Statistics Agency (BPS) in 2015, the

development of a harvested area, production and productivity of cayenne pepper in Lampung Province in 2011-2015 continued to decline. In 2014-2015, the area of cayenne pepper plants decreased from 2,501 hectares to 2,006 hectares. The decrease of harvested area occurs due to the reduction in agricultural land due to the conversion of land for housing. This can be overcome by cultivating cayenne plants using hydroponic techniques (Purnomo, 2018), (Agus and Handoko, 2014).

Fertilization is needed to meet the nutrients needed by plants. Fertilizer serves as one of the sources of nutrients needed to resolve macro and micro nutrient deficiencies. Provision of fertilizer needs to pay attention to the needs of plants (Susetya, 2014). The use of inorganic fertilizers in vegetable farming systems provides maximum growth and high yields. However, the use of inorganic fertilizers continuously can cause problems for the environment and human health. Long studies on various crops show that the use of NPK fertilizer cannot consistently produce high yields, because it causes deficiency and deterioration in soil physical proper. Rachmadhani & Santoso (2014) reported that the use of organic fertilizers when combined with inorganic fertilizers would provide maximum results. Today consumers are not only concerned with the good quality of agricultural commodities, but safe agricultural products are also an option.

Liquid organic fertilizer can overcome the use of inorganic fertilizers that are excessive, able to provide nutrients needed by plants. Several studies using liquid organic fertilizer have been proven to be able to help grow and increase the production of cayenne pepper plants (Safitri, 2017) has used liquid organic fertilizer of goat manure fermented with EM4 on cayenne pepper plants. The results showed a significant effect on plant height, number of branches, and fruit weight because they contained macro and micro nutrients needed by cayenne pepper plants.

Chemical fertilizer is the main fertilizer in the hydroponic growing system. Chemical fertilizers with high concentrations will pose a risk to consumers, namely the accumulation of toxic compounds in vegetables. If chemical fertilizers are used for a long time, there will be accumulation of nitrates that are harmful to the health of human and cultivated plants (Anjana & Iqbal (2007), Ikemoto & Kobayashi, 2002), (Ishiwata *et al*., 2002)

Currently, hydroponic farmers use factory-made nutrition, namely AB Mix. Dependence on fertilizer requires extra costs, excessive use can pollute the surrounding environment. The use of liquid organic fertilizer as a substitute for chemical fertilizer supplements is an interesting solution to the hydroponic system. Phibunwatthanawong (2019) Many farmers were intrigued to use liquid organic fertilizer in hydroponic farming. Organic fertilizers are generally not soluble in water, this fertilizer will be converted slowly into soluble fertilizer which is treated with water by microorganisms. Due to the high macro and micro nutrient content in liquid organic fertilizer, this fertilizer can be applied in hydroponic farming systems. The basic ingredients of liquid organic fertilizer are plants around us (Phibunwatthanawong, 2019).

Research into making liquid organic fertilizer has been carried out by utilizing the rest of the plants around us. Yasin, (2016) uses liquid organic fertilizer of gamal leaves containing macro and micro nutrients needed by plants so that it affects the height and number of panicles of rice plants.

Another plant that can be used as an ingredient for making organic fertilizer is bamboo shoots. The bamboo population

is quite large, but its utilization is not optimal. Bamboo shoots are generally consumed as vegetables. As bamboo shoots plants can be used as a basis for making organic fertilizer (Gustomi, Nurusman, & Susilo, 2018). According to Nizar (2018) liquid bamboo shoot organic fertilizer solution has a high content of organic C and gibberellins so that it can stimulate plant growth. Bamboo shoot liquid organic fertilizer contains organisms that are important to help plant growth, namely Azotobacter and Azospirillum. Azotobacter and Azospirillum are non-symbiotic N-binding bacteria that produce nitrogenase enzymes, growth hormones, and can be used for all types of plants (Sufianto, 2018).

Research conducted by (Angraini *et, al.*, 2018) using liquid organic bamboo shoots, significantly affected the growth of water spinach plants. Pre-anthesis is the time when plants do not produce flowers. This period is very important for growth because it will determine the next growth, when the post anthesis, where plants will produce flowers, and subsequently will produce fruit. Raden, (2017) found that there is a relationship between the number of leaves during the pre-anthesis period with crop yields on plant wheat. Based on the content in bamboo shoots, the researchers are interested in the use of liquid organic bamboo fertilizer on the growth of pre-anthesis cayenne pepper plants (*Capsicum frutescens* L.) hydroponically.

Materials and Methods

This research was conducted in the greenhouse of UIN Raden Intan Lampung in December 2018 until February 2019. The tools used in this study were plastic bottles, plastic jars, buckets, blenders, scales, wax glue, pans, stoves, knives, stirrers, measuring cup, duct tape, label paper, stationery, and cameras. The research sample was 30 cayenne pepper plants.

The study used a completely randomized design (CRD) with 6 treatments with 5 replications. The treatment in this study was the dose of Liquid Organic Fertilizer (POC) from Bamboo Shoots with the following concentrations (Angrraini, , 2018), This research was conducted in the following stages.

Make liquid organic fertilizer

Before fermentation is carried out, EM 4 is activated by adding a sugar solution. The EM consists of photosynthetic bacteria, lactic acid bacteria, *actinomycetes*, yeast and fermented fungi. 200 mL EM4 is added to 1500 mL water added with 200 g sugar. This mixture is left for 3x24 hours. 1 kg of bamboo shoots then boil until cooked, then drain. Bamboo shoots are mixed by adding 1 L remaining cooking water until smooth. Distilled bamboo shoots are then mixed with EM4 which has been activated, left for 2 weeks to get POC (Angraini *et, al.*, 2018) The content of liquid organic fertilizer tested at the UPT Integrated Laboratory and the University of Lampung Innovation Technology Center.

Nursery and planting of cayenne pepper in a hydroponic manner

The medium for growing cayenne pepper is rockwool Growing cayenne pepper using the hydroponic axis system. The seeds used are white cayenne pepper varieties. Rockwool media is cut to a size of 3cm², then perforated using a toothpick to lay the seeds. Rockwool moistened with water. The growing seed is maintained for 21 days, until it has 2 to 3 leaves *(Safitri et al.*, 2017). Seedlings are ready to be transferred in plastic bottles that have been given a wick of flannel cloth and have been filled with husk, plastic bottles

are then placed in clean pots filled with liquid nutrition.

Data observation and analysis

The parameters observed in this study include plant height, stem diameter, number leaves and fresh weight. Data were analyzed by Variant Analysis (ANOVA) and then followed by LSD at a 5% confidence level using SPSS 17.0.

Results and Discussion

The content of Liquid Bamboo Organic Fertilizer

The content of bamboo shoot liquid organic fertilizer are N, P, and K can be seen in the table 1.

Table 1. Contents of Bamboo Shoot Organic Liquid Fertilizer

Parameter	Unit	Result	SNI : 19-7030-2004
N	%	0.77	>0.40%
P	%	0.08	>0.10%
K	%	0.36	>0.20%

The results of the test of the content of liquid organic fertilizer (POC) bamboo shoots showed that the nutritional content of the elements N and K exceeds the limit of SNI standards, while the element P did not. The low P nutrient content can cause the growth of cayenne plants to be suboptimal in the generative phase. The low P nutrient in POC is caused by bamboo shoots containing a small amount of P element, in every 100 g bamboo shoots contain P 50 mg and 533 mg K nutrient (Muthohiroh *et al.*, 2015).

Growth of Cayenne pepper

Plant height

The results of the observation of pre-anthesis cayenne pepper plant height by the hydroponic method can be seen in the figure 1.

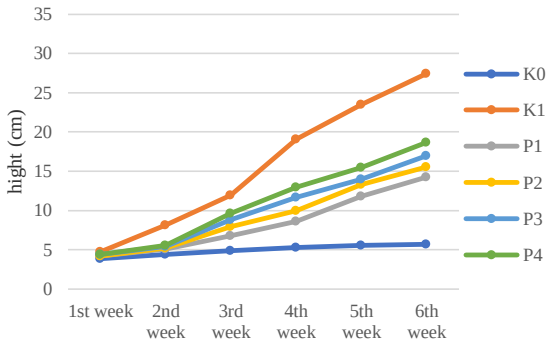

Figure 1. Average Height of Cayenne Pepper Plants

Figure 1 shows the difference in height of cayenne pepper between treatments for 6 weeks of observation. ANOVA analysis results showed that in the first week there was no effect of treatment on the height of cayenne plants. In the first week of cayenne pepper plants adapted to new growing media, plants have not utilized nutrients to the fullest, and are still utilizing water left on the rock woll, cayenne pepper roots have not yet reached the axis to absorb the available nutrients.

In the second to sixth week the treatment showed a significant effect by the ANOVA test. Positive control treatment (K1) using AB mix showed the best growth from week 2 to 6 when compared to other treatments. This is because AB mix contains complete macro and micro nutrients. Macronutrients N, P, K and micronutrients Fe, Mn, Zn, B, Cu and Mo. The results of the LSD test for the height of cayenne pepper can be seen in table 2 below:

Table 2. Height of hydroponic cayenne pepper plants with nutrients liquid organic bamboo shoots fertilizer

Treatment	Times					
	1st week	2nd week	3rd week	4th week	5th week	6th week
K0	3.86±0.45	4.4±0.23^{a}	4.9±0.22^{a}	5.28±0.41^{a}	5.56±0.43^{a}	5.72±0.43^{a}
K1	4.76±0.78	8.16±0.34b	11.96±0.59^{b}	19.06±1.11^{b}	23.5±01.12^{b}	27.4±0.96^{b}

Treatment	Times					
	1st week	2nd week	3rd week	4th week	5th week	6th week
P1	4.24±0.25	5.06±0.27c	6.76±0.44^{c}	8.62±0.43^{c}	11.8±0.43^{c}	14.28±0.43^{c}
P2	4.24±0.36	5.22±0.24cd	7.92±0.32^{d}	9.96±0.28^{d}	13.3±0.28^{d}	15.54±0±.68^{d}
P3	4.4±0.22	5.42±0.08de	8.82±0.49^{e}	11.68±0.35^{e}	14±0.35^{e}	17±0.53^{e}
P4	4.44±0.29	5.56±0.27e	9.66±0.46^{f}	13±0.5^{f}	15.5±0.50^{f}	18.64±0.41^{f}

Note: numbers followed by unequal letters in the same column indicate markedly different with LSD Test

LSD test results showed that in the second week some treatments did not show any different effects (P1 and P2. P3 and P4). In the 3rd to 6th week, there is a different effect on all treatments given. The bamboo shoot liquid organic fertilizer which gives the highest effect is P4 treatment, which is giving 250 mL POC. Nitrogen content of 0.77% and also potassium of 0.36% at POC exceeds SNI standards for liquid organic fertilizer content. This will certainly affect the growth of cayenne pepper plant height because nitrogen functions to accelerate plant growth, especially in the pre-anthesis phase. Potassium which is quite high in POC works synergistically with the element N because it will accelerate the metabolism of the nitrogen element in the plant body.

In addition to the high N content, liquid organic fertilizer also contains gibberellins. The negative control (K0) treatment showed the smallest results compared to other treatments. This is caused by the growth media negative control only water that does not get any additional nutrients.

Number of Leaves

Along with the increase in height of cayenne plants. The number of leaves during 6 weeks of treatment can be seen and shows the difference in the number of leaves between treatments in various ages of pre-anthesis cayenne pepper plants in the following figure 2.

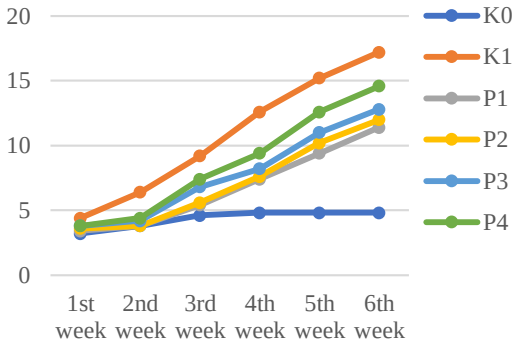

Figure 2. Number of leaves cayenne pepper plant

ANOVA test results showed the effect of treatment on the number of leaves in the second to the sixth week. Positive control (K1) shows the best results at each observation. The results of further tests with LSD can be seen in table 2. This is because the nutrient AB mix solution is a nutrient that is recommended in hydroponic cultivation. Hydroponic planting using AB Mix produces pakchoi plants with a higher number of leaves compared to the use of liquid organic fertilizer (Nur & Raihan, 2017).

Starting in the third week, the number of leaves in all treatments showed a significant difference. The best treatment is to use AB mix. The treatment dose using liquid organic fertilizer is 250 mL POC in one liter of water. The higher the concentration of liquid organic fertilizer solution, causing growth of cayenne plants is also higher, especially in the number of leaves (Table 3).

Table 3. Number of leaves of hydroponic cayenne pepper plants with nutrients Liquid organic bamboo shoots fertilizer

Treatment	Times					
	1st week	2nd week	3rd week	4th week	5th week	6th week
K0	3.2±0.45^{a}	3.8±0.45^{a}	4.6±0.54^{a}	4.8±0.44^{a}	4.8±0.44^{a}	4.8±0.44^{a}

Treatment	Times					
	1st week	2nd week	3rd week	4th week	5th week	6th week
K1	4.4±0.55[b]	6.4±0.55[b]	9.2±0.83[b]	12.6±0.84[b]	15.2±0.84[b]	17.2±0.83[b]
P1	3.4±0.55[a]	3.8±±0.55[a]	5.4±0.54[ac]	7.4±0.53[c]	9.40±53[c]	11.4±0.54[c]
P2	3.6±0.55[a]	3.8±0.55[a]	5.6±0.55[c]	7.6±0.54[cd]	10.2±0.83[cd]	12±1.0[cd]
P3	3.8±0.45[ab]	4.2±0.45[a]	6.8±0.84[d]	8.2±0.45[d]	11±0.71[d]	12.8±0.84[d]
P4	3.8±0.55[ab]	4.4±0.45[a]	7.4±0.55[d]	9.4±0.55[e]	12.6±0.55[e]	14.6±0.55[e]

Note: numbers followed by unequal letters in the same column indicate markedly different

It is assumed that the higher the concentration of POC solution used, the higher the nutrient content in the hydroponic nutrient solution (Kasi, Suaedi, & Angraeni, 2018). The results of this study are in accordance with the results of Deore, Limaye, Shinde, & Laware (2010) study which applied liquid organic fertilizer on red chilly plants. 3% concentration is a dose of liquid organic fertilizer that can increase plant height, number of leaves, fresh weight, dry weight and number of red chilies.

Macro nutrients such as nitrogen, phosphor, and potassium are found in bamboo shoots POC. These three elements play an important role in plant growth. Based on the analysis of bamboo shoots POC levels indicate that the phosphorus levels in bamboo shoots POC are relatively low and do not meet SNI standards. This causes the number of leaves that are owned by hydroponic chili with POC bamboo shoots nutrition has fewer leaves than the hydroponic chili peppers with nutrient mixture AB. Phosphorus plays an important role in metabolism, plants that lack phosphorus can cause leaf loss, the formation of anthocyanins and plants tend to be dark green (Alfi, 2017).

Stem Diameter and Fresh Weight

Stem diameter was observed at week 6. Results of observations and LSD tests on stem diameter and fresh weight of hydroponic cayenne pepper plants in the sixth week using liquid organic bamboo shoots can be seen in table 4.

Table 4. Stem diameter and fresh weight of hydroponic with liquid organic fertilizer bamboo shoots

Treatment	Stem Diameter	Fresh Weight
K0	0.15±0.16[a]	1±0.025[a]
K1	0.71±0.83[b]	25.2±0.016[b]
P1	0.32±0.71[c]	7±0.021[c]
P2	0.39±1.0[d]	9±0.016[d]
P3	0.47±1.0[e]	12±0.021[e]
P4	0.55±0.83[f]	16.8±0.016[f]

Note: Numbers followed by unequal letters in the same column indicate markedly different

The positive control (K0) treatment using the hidroponik AB mix nutrient produced the highest stem diameter and fresh weight compared to other treatments. AB mix nutrition contains complete macro and micro nutrients which give a big influence on the growth of pre-anthesis. The concentration of AB mix nutrition in accordance to the rules of use in the hydroponic system of cayenne pepper plants growing optimally (Purnomo *et al.*, 2018).

The application of bamboo shoot liquid organic fertilizer produces different stem diameters and wet weights. Treatment with 250 ml of POC gives the best results when compared with other doses.

High potassium in POC bamboo shoots can activate enzymes for photosynthesis and respiration. Potassium activates enzymes to form starch and proteins function in the process of transpiration, especially in the process of opening the stomata (Salisbury & Ross, 1995). Stomata open because guard cells absorb water, potassium ions move from neighboring cells to guard cells, the

main requirement for transpiration is the evaporation of water from the leaves and the opening of stomata (Salisbury & Ross, 1995).

Bamboo shoot liquid d organic fertilizer also contains local microorganisms that can help the process of plant growth. Azotobacter and Azospirillum function as a producer of growth hormone and air nitrogen inhibitors. Azotobacter comes from the fermentation process which is added by EM4. EM4 contains lactic acid bacteria, photosynthetic bacteria, yeast, fermented fungi, soluble bacteria such as phosphate solvent bacteria and nitrogen-fixing bacteria, namely Azotobacter (Rachmadhani & Santoso, 2014)). The results of MOL analysis of bamboo shoots in a study conducted by *(Kasi et al.*, 2018), bamboo shoot MOL contains nitrogen-fixing bacteria, and potassium-solvent bacteria. In the treatment carried out by Gustomi *et al*., (2018) bamboo shoot MOL affects the fresh weight of plants because the root diffusion process of nutrients has been going well so that organic ions dissolved in water accumulate and can be transplanted to all plant organs optimally.

Conclusion

Based on the results of the research that has been done, it can be concluded that the liquid organic fertilizer of bamboo shoots can be used for hydroponic cultivation of cayenne pepper. The most effective dose is the fourth dose, which is 250 ml added to 1 liter of water.

References

Agus, H; Handoko, H. (2014). *Bertanam Sayuran Hidroponik Ala Paktani Hydrofarm.* Jakarta: PT Agro Media Pustaka.

Alfi, S. (2017). *Kiat Sukses Budidaya Cabai Rawit .No Title*. Yogyakarta.

Ama Kii,FH; H, Jannah; B, Mirawati, B. (2018). Pengaruh Pupuk Guano Burung Walet Terhadap Pertumbuhan Tanaman Cabai Rawit (Capsicumfrutescens L.). In *Prosiding Seminar Nasional Lembaga Penelitian dan Pendidikan (LPP) Mandala* (pp. 2016–2018).

Angraini, F; PD, Kasi; Suaedi; Sanmas, S. (2018). Pemnfaatan Ppupuk Organik Cair Rebung Bambu Untuk Pertumbuhan Kangkung Secara Hidrop0nik. *Jurnal Biologi Science & Education*, *7*(1), 42–48.

Anjana, SU; Iqbal, M. (2007). Nitrate accumulation in plant.Factor Affecting the Proses and Human Health Implication. *A Review Agron Sustain Dev.*, 27(1), 45–57.

Deore, G., Limaye, A., Shinde, B., & Laware, S. (2010). Effect of novel organic liquid fertilizer on growth and yield in chilli (Capsicum annum L.). *Asian Journal of Experimental Biological Sciences (2010 Spl Issue)*, 15–19.

Gustomi, G., Nurusman, L., & Susilo, S. (2018). Pengaruh Pemberian Mikroorganisme Lokal (MOL) Rebung Bambu Surat (Gigantochloa vesticillata (Willd.) Munro) terhadap Pertumbuhan Bayam Merah (Amaranthus tricolor L.). *Bioeduscience*, 2(1), 81.

Ikemoto, Y., Teraguchi, M., & Kobayashi, Y. (2002). Plasma levels of nitrate in congenital heart disease: Comparison with healthy children. *Pediatric Cardiology*, 23(2), 132–136.

Ishiwata, H., Yamada, T., Yoshiike, N., Nishijima, M., Kawamoto, A., & Uyama, Y. (2002). Daily intake of food additives in Japan in five age groups estimated by the market basket method. *European Food Research and Technology*, 215(5), 367–374.

Kasi, P. D., Suaedi, S., & Angraeni, F.

(2018). Pemanfaatan Pupuk Organik Cair Rebung Bambu U Ntuk Pertumbuhan Kangkung Secara Hidroponik. *Biosel: Biology Science and Education*, 7(1), 42.

Muthohiroh, M., Sulandjari, S., Program, D., Tata, S., Fakultas, B., Universitas, T., & Surabaya, N. (2015). Pengaruh Subtitusi Tepung Rebung Dan Penambahan Tahu. *Pengaruh Subtitusi Tepung Rebung Dan Penambahan Tahu Terhadap Mutu Organoleptik Nugget Mureta*, *04*, 9–17.

Nizar, A. (2018). Pengaruh Penggunaan Rebung Bambu sebagai Zat Pengatur Tumbuh terhasdap Pertumbuhan dan Produksi Bawang Merah (Allium ascolonicum L) Varietas Lokal Bauji. *Agriekstensia : Jurnal Penelitian TYerapan Bidang Pertanian*, 17(2), 92–98.

Nur, M. U. H., & Raihan, A. (2017). *Pertumbuhan dan Perkembangan Tanaman Pakchoy (Brassica chinensis L) Pada Berbagai Konsentrasi Pupuk ABmix dan Pupuk Organik Cair (POC) dengan Teknik Hidroponik Pertumbuhan dan Perkembangan Tanaman Pakchoy (Brassica chinensis L) Pada Berbagai Konse*. Universitas Hasanudin.

Phibunwatthanawong T, T., & Riddech, N. (2019). Liquid organic fertilizer production for growing vegetables under hydroponic condition. *International Journal of Recycling of Organic Waste in Agriculture*, 8(4), 369–380.

Purnomo, D., Harjoko, D., & Sulistyo, T. D. (2018). Budidaya Cabai Rawit Sistem Hidroponik Substrat Dengan Variasi Media Dan Nutrisi. *Caraka Tani: Journal of Sustainable Agriculture*, 31(2), 129.

Rachmadhani, N. W., & Santoso, M. (2014). Pertumbuhan Dan Hasil Tanaman Buncis Tegak (*Phaseolus vulgaris* L.) Effect Of Organic And Anorganic Fertilizer On The Growth And Yield Of Kidney Bean (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*, 2(6), 443–452.

Raden, Z. (2017). *Pertumbuhan Vegetatif Tanaman Cabe Rawit (Capsicum Frutescen yang diberikan Trichoderma sp dengan Dosis yang berbeda*. Universitas Negeri Gorontalo.

Safitri, A. D., Linda, R., & Rahmawati. (2017). Aplikasi Pupuk Organik Cair (POC) Kotoran Kambing Difermentasikan Dengan EM4 Terhadap Pertumbuhan Dan Produktivitas Tanaman Cabai Rawit (Capsicum frutescents L .) Var . Bara. *Jurnal Protoboint*, 6(3), 182–187.

Salisbury, FB. dan Ross, C. (1995). *Fisiologi Tumbuhan Jilid 1*. Bandung: ITB Pers.

Sufianto. (2018). Analisis mikroba pada cairan sebagai pupuk cair limbah organik dan aplikasinya terhadap tanaman pakcoy. *Jurnal Agronomi*, 9(2), 77–94.

Susetya, D. (2014). *Panduan Lengkap Membuat Pupuk Organik Untuk Tanaman Pertanian Dan Perkebunan.* Yogyakarta: Pustaka Buku Press.

Yasin, S. M. (2016). Respon Pertumbuhan Padi (*Oryza Sativa* L.) Pada Berbagai Konsentrasi Pupuk Organik Cair Daun Gamal. *Jurnal Galung Tropika*, 5(1), 20-27.