LenteraBio
p-ISSN: 2252-3979 e-ISSN: 2685-7871

# Effectiveness of LOF Mixture from Banana Peel with Rice Water and Goat Manure on the Growth of Hydroponic *Brassica juncea*

## *Efektivitas POC Campuran Kulit Pisang, Air Cucian Beras, dan Kotoran Kambing Terhadap Pertumbuhan Brassica juncea Hidroponik*

**Annisa Ulfa Luthfiyah, Ranti An Nisaa*, Maryanti Setyaningsih, Devi Anugrah**
Department of Biology Educational
Faculty of Teacher Training and Education
Muhammadiyah Prof. Dr. Hamka University, Jakarta, Indonesia
*e-mail: ranti.anisa@uhamka.ac.id

**Abstract.** Liquid organic fertilizer is a nutrient made from organic materials from animal and plant waste. The use of banana peels, rice water, or goat manure as LOFs was reported to affect the growth of mustard greens and several types of vegetables. The use of LOF made from a mixture of these three organic ingredients has never been done to see its effect on the growth of mustard greens. Completely randomized design was performed with four treatments, P0 = control, P2 = 2% LOF, P3 = 5% LOF, and P4 = 7.5% LOF, with 5 repetitions. Parameters of plant were observed until 42 DAP. The results of the ANOVA test for plant height calculation F count = 7.62; number of leaves F count = 4.5; wet weight F count = 1.33; and dry weight F count = 2.54. Based on this test, it can be seen that the LOF of the mixture from banana peels, rice water, and goat manure only affected plant height, while the number of leaves, wet weight, and dry weight had no effect. The nutritional content of POC is still less than that required by mustard greens, this POC does not have a positive impact.
**Keywords:** organic waste; green mustard; liquid organic fertilizer; agricultural productivity

***Abstrak.*** *Pupuk Organik Cair (POC) merupakan nutrisi untuk tanaman hidroponik yang terbuat dari bahan organik yang berasal dari limbah hewan dan tumbuhan. Penggunaan kulit pisang, air cucian beras, atau kotoran kambing sebagai POC dilaporkan berpengaruh terhadap pertumbuhan sawi dan beberapa jenis sayur lainnya. Pemanfaatan POC yang terbuat dari campuran ketiga bahan organik tersebut belum pernah dilakukan untuk melihat pengaruhnya terhadap pertumbuhan sawi hijau. Teknik rancangan acak lengkap (RAL) dilakukan dengan empat pelakuan yaitu P0 = kelompok kontrol, P2 = 2% POC, P3 = 5% POC, da P4 = 7,5% POC, dengan 5 kali pengulangan. Parameter tinggi tanaman, jumlah daun, berat basah, dan berat kering diamati. Hasil uji ANOVA perhitungan tinggi tanaman F hitung = 7,62; jumlah daun F hitung = 4,5; berat basah F hitung = 1,33; dan berat kering F hitung= 2,54. Berdasarkan uji tersebut terlihat bahwa POC campuran kulit pisang, air cucian beras, dan kotoran kambing hanya berpengaruh terhadap tinggi tanaman, sedangkan jumlah daun, berat basah, dan berat kering tidak berpengaruh. Parameter jumlah daun, berat basah, dan berat kering tertinggi justru pada kelompok kontrol. Kandungan nutrisi dari POC diketahui masih kurang dari yang dibutuhkan oleh sawi hijau sehingga POC ini tidak memberikan dampak positif.*
***Kata kunci:*** *limbah organik; pupuk organik cair; sawi hijau; produktivitas agrikultur*

## INTRODUCTION

Hydroponics is one of the easiest farming systems to do in a narrow area because it does not require large spacing (Zamriyetti *et al.,* 2019). Almost all types of plants can be grown using a hydroponic system, especially seasonal plants such as mustard greens (Roidah, 2014). Mustard greens are among the most popular vegetables because of their delicious taste and complete nutritional content (Munthe *et al*., 2018). Indonesia is easily overgrown by various kinds of crops such as mustard greens because of its mineral-rich soil (Istianto *et al.,* 2013). However, in 2015 – 2017 the production of mustard greens decreased to 2,596 tons (Statistik, 2019). The decline in mustard production is also accompanied by a decrease in land for farming in urban areas such as Jakarta and high levels of soil pollution (Nurifah and Fajarfika, 2020). Hydroponics is an alternative to growing mustard greens in narrow areas (Purwanto *et al.,* 2018).

Hydroponic growing media generally use materials in the form of rockwool, cocopeat, husk charcoal, gravel, coconut fiber, silicate substances, and sand (Nurjannah and Giono, 2022). The planting

media are then given water equipped with nutrients such as AB mix, NPK fertilizer, or liquid organic fertilizer (Rizal, 2017). Liquid organic fertilizer (LOF) is a fertilizer made from animal waste, vegetables, fruit, etc. which is fermented by decomposers with the final product in the form of liquid (Nasrun *et al.,* 2017). Several LOFs made from banana peels, rice water, and goat manure are known to increase the growth of several types of vegetable crops.

LOF from banana peel waste with a concentration of 80 ml/polybag showed an increase in the production of mustard greens on the parameters of plant height, leaf area, and fresh weight (Hernosa *et al.,* 2015). Rice water with a concentration of 20 ml/L has an effect on plant height and number of leaves on mustard greens (Hairuddin and Mawardi, 2017). LOF from goat manure with a concentration of 250 ml/plant increased the number of leaves and plant height in celery (Hairuddin and Edial, 2019). LOF contains macronutrients nitrogen for the formation of protein, amino acids, and chlorophyll, as well as micronutrients as catalysts in the process of protein synthesis and constituent of chlorophyll (Muhadiansyah *et al.,* 2016). In addition, because LOF contains organic elements that will make the soil and growing media become humus and fertile (Hairuddin and Edial, 2019).

The combination of the three organic materials into LOF and their application to mustard plants has never been done. With research showing that the three organic materials have each been shown to increase the growth of vegetable crops, the researchers hope that the administration of LOF from banana waste, rice water, and goat manure can have a positive effect on the growth of mustard greens.

## METHODS

The quantitative experimental method of this study used a completely randomized design (CRD) technique with a total of 4 treatments based on the concentration of LOF given, namely P1 = control treatment with no POC given, P1 = 2%, P2 = 5%, and P3 = 7.5%. Each treatment was repeated 5 times so that there were 20 plants.

200 grams of brown sugar is dissolved in 250 ml of water by heating**.** Goat dung as much as 1 kg is mashed with a blender then filtered until it becomes fine granules. Wash 5 kg of banana peel and cut into small pieces. The banana peel is mashed together with 8 L of rice water using a blender. The mashed banana peel is put into a plastic bucket, added 200 ml of EM4, 200 ml of brown sugar water, and goat manure, then stirred until well mixed. Next, in another bucket, the mixture is filtered, tightly closed, and left for about 4-7 weeks to ferment. is to close tightly and leave the LOF solution for 4-7 weeks until all the ingredients are well fermented which is characterized by the presence of gas, sour aroma, and cloudy color in the solution (Sulfianti *et al.,* 2021).

LOF that has not been diluted needs to be tested for its nutritional content in the form of the percentage of nutrients contained in it. The composition of LOF can be seen in Table 1.

**Table 1.** Composition of LOF mixture of banana peel, rice water, and goat manure

| Nutrient | Concentration (%) |
|---|---|
| C – organic | 0.55 |
| N total | 0.04 |
| P | 0.02 |
| K | 0.11 |
| Mg | 0.01 |
| Ca | 0.06 |

Green mustard seeds are sown on rice husk charcoal planting media which is placed on a tray, then the seeds are sown and spaced about 2-4 cm between the seeds. The seeds are treated until they have 3 or 4 leaves or about 10-14 days by watering them every morning at 07.00 – 09.00 and in the afternoon at 16.00 – 17.00.

The green mustard that has been sown is then transferred with the husk charcoal to a plastic bottle that has been cut and given a flannel cloth at the bottom of the bottle and placed on top of the reservoir. This hydroponic method is called the wick system by utilizing the capillarity principle of the nutrient solution from the reservoir to the plant roots (Nurifah and Fajarfika, 2020).

The LOF given to the mustard greens was diluted with water to reach a solution of 1000 ml and converted to a percentage of the solution concentration. Before the water is mixed with LOF, the solids content in the water is measured with a TDS meter. It is known that water has a solids concentration of 60-70 ppm. The LOF dilution for each treatment and the concentration of the LOF solution are as follows:

P0= 0 ml LOF + 1000 ml water= 0% (control)
P1= 20 ml LOF + 980 ml water= 2%
P2= 50 ml LOF + 950 ml water= 5%
P3= 75 ml LOF + 925 ml water= 7.5%

The diluted LOF solution was re-measured for its solid content and it was known that the solids concentration was in the range of 250 – 14000 ppm. Then the LOF solution is poured into the plant reservoir according to the treatment group. Treatment in the form of fertilization was applied at the beginning (first day) the plants were transferred from the nursery to the media in plastic bottles and up to 42 DAP (Days After Planting). The fertilizer application was adjusted to the treatment groups P0, P1, P2, and P3. LOF is inserted in the planting media storage container which is connected to the flannel cloth in the bottle. Plant maintenance is done by watering with water, checking pests every day, and the availability of LOF nutrients.

The data measured was environmental physical conditions around the plant every 7 days, i.e at 7 DAP to 42 DAP. This physical data is in the form of direct weather observations and temperature measurements with a room thermometer. Growth parameters measured of mustard greens harvested at 42 DAP including plant height, measured from the base of the stem to the base of the leaf (growing point); number of leaves, counted leaf blades that have been fully opened; wet weight, the whole plant is weighed from root to leaf immediately after harvest; and dry weight, the whole plant was weighed from roots to leaves after drying in the oven until it reached a stable weight. The way to get a stable weight is by drying the plants over a certain period of time, then weighing them. Dry the plant repeatedly until there is no further weight loss.

Plant data were analyzed using one-way ANOVA test which was at a significance level of 1% (α 0.01) which was then followed by Duncan test (DMRT) with a significance level of 1% (α 0.01) to examine whether there was an effect on the treatment.

## RESULT

The data displayed in the form of environmental physical data every 7 DAP and the growth parameters of mustard greens at 42 DAP. The environmental conditions around the plants are shown in Table 2.

**Table 2.** Observation of the environmental conditions of mustard plants

| Day After Planting (DAP) | Weather | Temperature ($^0$C) |
|---|---|---|
| 7 | Hot | 33.3 |
| 14 | Hot | 35.0 |
| 21 | Cloudy | 29.3 |
| 28 | Rain | 23.2 |
| 35 | Rain | 25.3 |
| 42 | Hot | 35.5 |

Table 3 shows the growth parameters of mustard plants given LOF from banana peels, rice water, and goat manure. These parameters included the mean of plant height, number of leaves, wet weight, and dry weight after harvest at 42 DAP.

**Table 3.** Average growth parameters of mustard greens at 42 DAP

| Treatment | Plant height (cm) | Number of leaves (blades) | Wet weight (g) | Dry weight (g) |
|---|---|---|---|---|
| P0 (0%) | 5.8$^b$ | 5.6 | 4.14 | 0.13 |
| P1 (2%) | 6.14$^b$ | 3.8 | 3.62 | 0.09 |
| P2 (5%) | 8.6$^a$ | 4.4 | 3.78 | 0.1 |
| P3 (7,5%) | 5.52$^b$ | 3.6 | 3.32 | 0.07 |

**Note:** Numbers followed by the same letter are not significantly different at a significance level of 1%

Table 3 shows that the administration of LOF from banana peels, rice water, and goat manure only affected the height of the mustard plant. This is indicated by the difference in plant height after LOF administration at P2 (5%) which was significantly different from P0 (0% LOF), P1 (2% LOF), and P3 (7.5% LOF) compared to other parameters which tended to down. In other parameters the growth rate was higher when not given LOF or only given water without nutrients (control treatment).

Based on Table 3, it is known that P2 (5% LOF) showed the highest average plant height compared to other treatments, which was 8.6 cm. On the other hand, the lowest plant height was shown in treatment P3 (7.5% LOF) of 5.52 cm which was a significant decrease in plant height. The results of the ANOVA test calculation showed that there was an effect on the administration of LOF from banana peels, rice water, and goat manure.

Table 3 shows that the control treatment gave the highest average number of mustard leaves, which was 5.6 leaves when not given LOF. The lowest average number of leaves was in the P3 treatment with a LOF concentration of 7.5%, which was 3.6 leaves. The number of leaves in the ANOVA test emphasized that there was no effect of giving LOF banana peels, rice water, and goat manure on the number of leaves of mustard plants.

The highest wet weight was in the control treatment which showed an average wet weight of 4.14 grams compared to other treatments (Table 3). The lowest wet weight of the mustard plant was indicated by the highest concentration of LOF, which was 7.5% at 3.32 gr. Based on the ANOVA test, it showed that the administration of LOF banana peels, rice water, and goat manure had no effect on the wet weight of mustard plants.

Similar to the growth parameters of leaf number and wet weight, dry weight in the control treatment resulted in the highest growth of 0.13 g (Table 3). With the lowest weight (0.07%) given the LOF concentration of 7.5%, it illustrates that the higher the LOF concentration, the lower the dry weight. ANOVA concluded that there was no effect on the dry weight of mustard plants given LOF banana peels, rice water, and goat manure.

## DISCUSSION

Referring to the results in Table 3. illustrates that the administration of LOF consisting of a mixture of banana peels, rice water, and goat manure did not affect almost all the growth parameters of mustard greens except for the height of the mustard plant. The results of the LSD test with LOF on plant height showed a significant difference. If the concentration of fertilizer is low, then plant growth is good. On the other hand, the higher the concentration of fertilizer, the lower the yield. This is because the LOF s olution is saturated with high concentrations, causing disturbances in the osmotic balance in plant cells (Sopandie, 2014).

Treatment P2 (5% LOF) showed the best results on the measurement of plant height parameters. It is known that banana peel waste contains several Actinobacteria which are gram-positive bacteria that have bioactive compounds that play a role in plant growth (Cruz *et al.*, 2019). In addition, banana peel waste contains gibberellic acid which can stimulate the growth of the gibberellin hormone (Omojasola and Adejoro, 2018). The gibberellin hormone plays an active role in stimulating plant growth such as stem elongation, leaf maturation, and fruit (Advinda, 2018). Liquid organic fertilizer of banana peel waste contains macro and micro nutrients such as N, P, K, Mg, Ca, and Zn (Nasrun *et al.*, 2017).

Based on the results of the LOF content test at the Laboratory of Agronomy and Horticulture, Bogor Agricultural University, it was shown that the liquid organic fertilizer content of banana peel waste with a mixture of rice water and banana manure had a C-organic content of 0.55%; nitrogen (N) 0.04%; phosphorus (P) 0.02%; potassium (K) 0.11%; magnesium (Mg) 0.01%; and calcium (Ca) 0.06%. This is not in accordance with the provisions of the national nutrient standard that C-organic fertilizer has a minimum content of 15%, nitrogen is at least 2%, phosphorus is at least 2%, and potassium is at least 2% (Hairuddin and Edial, 2019).

The control treatment showed the highest yield on the calculation of the average number of leaves, possibly because the plant was not attacked by *Fusarium oxysporum*, whereas in other treatments some of the plants appeared to be growing with this fungus. Meanwhile, the 7.5% LOF treatment showed the lowest results compared to the control group. This is due to the very high concentration of the solution, which affects the osmotic balance and causes plants to experience stress (Sopandie, 2014). In addition, the increase in the number of leaves is strongly influenced by the availability of nutrients in fertilizers. Nitrogen is one of the most important nutrients needed by plants. The low nitrogen content in this LOF is known to have nitrogen of 0.04% which makes it difficult for plant leaves to grow and develop properly (Phibunwatthanawong and Riddech, 2019).

Wet weight of plants is influenced by plant height, number of leaves, and water absorption in plants. The lower the water absorption capacity of the plant, the lower the water content contained in the plant (Sopandie, 2014). On the other hand, the higher the water content in the plant, the faster the process of enlargement or elongation of the plant will be (Hamim, 2018). The wet weight of the plant is

highly dependent on photosynthesis. Photosynthesis plays a role in the formation of carbohydrates in plants. The more carbohydrates produced indicates the plant has sufficient availability of nutrients. Conversely, the lighter the wet weight of the plant, it indicates that the plant does not have sufficient nutrients (Advinda, 2018). In Table 2 it is known that the ambient temperature is quite high. This can cause a protein denaturation process that plays a role in the formation of the rubisco enzyme in plants so that the photorespiration process is more dominant than photosynthesis (Hamim, 2018). This affects the low wet weight of the plant.

Based on the results of the ANOVA test calculation on the parameters of the number of leaves, wet weight and dry weight of plants, it was found that there was no significant effect of fertilizer on plants. This is in line with research conducted by Palupi (2015) that there is no effect of liquid organic fertilizer from banana peel waste on the growth rate of mustard plants. This is because the content of liquid organic fertilizer in banana peel waste does not meet the national organic fertilizer standards so that it is not able to meet the nutritional needs of mustard plants. However, the research by Sepriani *et al.,* (2016) showed that there was a significant effect of undiluted liquid organic fertilizer of banana peel waste on the growth of mustard plants.

Growth in plants is also influenced by other factors. Physical environmental factors and the biological environment greatly affect the growth process in plants (Indriyanto, 2017). shows that there have been quite extreme changes in weather conditions and environmental temperatures. In these weather conditions, it can cause denaturation in plants so that the protein synthesis process is inhibited (Sopandie, 2014). Not only that, changes in weather also cause the emergence of pathogens on plants such as fungi especially in treatments P2 and P3. *Fusarium oxysporum* is one of the most common pathogens in the cultivation of mustard plants. This pathogen causes stem rot disease (Pinaria, 2020). The fungus *Fusarium oxysporum* belongs to the Deuteromycota class which has a very fast growth period (Suryani *et al.,* 2020). The optimal growth of Fusarium mushrooms is at a temperature of 25-30 $^0$C (Jelínek *et al.,* 2019). In addition, Fusarium fungus can grow at an ambient temperature of 24 -27 $^0$C (Kaya *et al.,* 2020). At 28 – 35 DAP, temperatures were recorded at 23.2 $^0$C and 25.3 $^0$C allowing this fungus to grow. This type of fungus is a parasite that attacks the xylem vessels of its host (Pattikawa *et al.,* 2020) so that the nutrients in these plants cannot be channeled. This is what is thought to cause the yield of mustard plants to not grow properly.

The emergence of *Fusarium oxysporum* is also influenced by the conditions of the growing media used. Husk charcoal is a growing medium that has a fairly high humidity (Sejati, 2017). It is known that the fungus likes an environment that has a humidity level of 60-80% (Kaya *et al.,* 2020). The higher t he humidity level, the easier it will be for the Fusarium fungus to breed. This fungus can be controlled by giving Trichoderma biological agents such as *Trichoderma harzianum* which can control Fusarium pests on chili, sweet potatoes, cabbage, and others (Pattikawa *et al.,* 2020).

Further research is needed on the impact of the Fusarium fungus on the growth of mustard greens. It is also necessary to monitor the humidity in the planting medium in order to prevent the appearance of the fungus. The addition of other nutrients is also important to compensate for the lack of nutrients from this LOF such as AB mix solution which is a suitable nutrient for hydroponic plants.

## CONCLUSION

The application of liquid organic fertilizer (LOF) derived from a mixture of banana peels, rice water, and goat manure only affected the growth of plant height in mustard greens, while other parameters such as number of leaves, wet weight, and dry weight had no effect. These three parameters tend to be high in the control treatment where mustard greens were not given LOF and decreased when given LOF. The appearance of Fusarium fungus on mustard greens may be the cause of the inhibition of mustard growth due to the moisture from the husk charcoal and the LOF solution itself. The addition of various types of organic matter to LOF does not have a positive effect on the growth of mustard greens.

## REFERENCES


Advinda L, 2018. *Dasar-Dasar Fisiologi Tumbuhan*. Yogyakarta: Penerbit Deepublish.

Cruz AF, Barka GD, Blum LEB, Tanaka T, Ono N, Kanaya S, and Reineke A, 2019. Evaluation of Microbial Communities In Peels of Brazilian Tropical Fruits By Amplicon Sequence Analysis. *Brazilian Journal of Microbiology*; *50*(3), 739–748.

Hairuddin R and Edial AA, 2019. Pengaruh Pemberian Pupuk Organik Cair Kotoran Kambing Terhadap Pertumbuhan Dan Hasil Tanaman Seledri (*Apium graveolens* L.). *Perbal : Jurnal Pertanian Berkelanjutan*; *7*(1),

97–106.
Hairuddin R and Mawardi R, 2017. Efektifitas Pupuk Organik Air Cucian Beras Terhadap Pertumbuhan Tanaman Sawi Hijau (*Brassica juncea* L). *Jurnal Perbal*; *3*(3), 79–84.
Hamim, 2018. *Fisiologi Tumbuhan 1 : Air, Energi dan Metabolisme Karbon*. Bogor: IPB Press.
Hernosa SP, Triyanto Y and Eko W, 2015. Pengaruh Pemberian Pupuk Organik Cair Kulit Pisang Terhadap Pertumbuhan Dan Produksi Tanaman Sawi (*Brassica juncea*). *Jurnal Agroplasma*; *2*(2), 15–21.
Indriyanto, 2017. *Ekologi Spesies Pohon*. Yogyakarta: Plantaxia.
Istianto T, Tanudjaja BB and B BS, 2013. Perancangan Board Game Tentang Bercocok Tanam Di Rumah. *Jurnal DKV Adiwarna*, *1*(2), 11-21.
Jelínek T, Koudela M, Kofránková V and Salava J, 2019. Effect of Temperature on Severity of Fusarium Wilt of Cabbage Caused by *Fusarium oxysporum* f. sp. conglutinans. *European Journal of Plant Pathology*; *155*(4), 1277–1286.
Kaya E, Mailuhu D, Kalay AM, Talahaturuson A and Hartanti AT, 2020. Pengaruh Pupuk Hayati Dan Pupuk NPK Untuk Meningkatkan Pertumbuhan Tanaman Tomat (*Solanum lycopersicum*) Yang Di Tanam Pada Tanah Terinfeksi *Fusarium oxysporum*. *Agrologia*; *9*(2), 81–94.
Muhadiansyah TO, Setyono and Adimihardja SA, 2016. Efektivitas Pencampuran Pupuk Organik Cair Dalam Nutrisi Hidroponik Pada Pertumbuhan Dan Produksi Tanaman Selada (*Lactuca sativa* L.). *Jurnal Agronida*; *2*(1), 37–46.
Munthe K, Pane E and Panggabean EL, 2018. Budidaya Tanaman Sawi (*Brassica juncea* L.) Pada Media Tanam Yang Berbeda Secara Vertikultur. *Agrotekma: Jurnal Agroteknologi Dan Ilmu Pertanian*; *2*(2), 138–151.
Nasrun, Jalaluddin and Herawati, 2017. Pemanfaatan Limbah Kulit Pisang Barangan Sebagai Bahan Pembuatan Pupuk Cair. *Jurnal Teknologi Kimia Unimal*; *5*(2), 19–26.
Nurifah G and Fajarfika R, 2020. Pengaruh Media Tanam pada Hidroponik terhadap Pertumbuhan dan Hasil Kailan (*Brassica oleracea* L.). *Jagros: Jurnal Agroteknologi dan Sains*; *4*(2), 281–291.
Nurjannah and Giono BRW, 2022. Pertumbuhan Sawi Pakcoy Sistem Hidroponik Wick pada Beberapa Media Tanam. *Jurnal Agrotan*; *8*(1), 14–17.
Omojasola PF and Adejoro DO, 2018. Gibberellic Acid Production by *Fusarium moniliforme* and *Aspergillus niger* Using Submerged Fermentation of Banana Peel. *Notulae Scientia Biologicae*; *10*(1), 60–67.
Palupi NP, 2015. Karakter Kimia Pupuk Cair Asal Limbah Kulit Pisang Kepok Dan Pengaruhnya Pada Tinggi Tanaman Kedelai. *Agrifor : Jurnal Ilmu Pertanian Dan Kehutanan*; *14*(2), 239–244.
Pattikawa AS, Pagaya J and Patty J, 2020. Pengujian Antagonisme Secara In Vitro Isolat Jamur *Trichoderma harzianum* Terhadap *Fusarium oxyzporum* f. sp. Cubense Penyebab Penyakit Layu Pada Tanaman Pisang Kepok (*Musa paradisiaca* normalis). *Rumphius Pattimura Biological Journal*; *2*(2), 016–022.
Phibunwatthanawong T and 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.
Pinaria A, 2020. *Jamur Fusarium yang Berasosiasi dengan Penyakit Busuk Batang Vanili di Indonesia*. Manado: Unsrat Press.
Purwanto E, Sunaryo Y and Widata S, 2018. Pengaruh Kombinasi Pupuk AB Mix Dan Pupuk Organik Cair (POC) Kotoran Kambing Terhadap Pertumbuhan Dan Hasil Sawi (*Brassica juncea* L.) Hidroponik. *Agroust. Jurnal Ilmiah Agroteknologi Fakultas Pertanian UST*; *2*(1), 11–24.
Rizal S, 2017. Pengaruh Nutriasi Yang Diberikan terhadap Pertumbuhan Tanaman Sawi Pakcoy (*Brassica rapa* L.) Yang Ditanam Secara Hidroponik. *Sainmatika: Jurnal Ilmiah Matematika Dan Ilmu Pengetahuan Alam*; *14*(1), 38–44.
Roidah SI, 2014. Pemanfaatan Lahan Dengan Menggunakan Sistem Hidroponik. *Jurnal Universitas Tulungagung Bonorowo*; *1*(2), 43–50.
Sejati TMA, 2017. *Teknik Hidroponik*. Solo: CV. Pustaka Bengawan.
Sepriani Y, Jamaluddin and Hernosa SP, 2016. Pengaruh Pemberian POC Kulit Pisang Kepok Terhadap Pertumbuhan Dan Produksi Tanaman Sawi Pahit (*Brassica juncea* L). *Jurnal Agroplasma*; *3*(1), 16–23.
Sopandie D, 2014. *Fisiologi Adaptasi Tanaman Terhadap Cekaman Abiotik pada Agroekosistem Tropika*. Bogor: IPB Press.
Statistik BP, 2019. *Statistik Hortikultura Provinsi DKI Jakarta 2019*.
Sulfianti, Risman and Saputri I, 2021. Analisis NPK Pupuk Organik Cair Dari Berbagai Jenis Air Cucian Beras Dengan Metode Fermentasi Yang Berbeda. *Jurnal Agrotech*; *11*(1), 36–42.
Suryani Y, Taupiqurrahman O and Kulsum Y, 2020. *Mikologi*. Padang: PT Freeline Cipta Granesia.
Zamriyetti, Siregar M and Refnizuida, 2019. Pertumbuhan dan Produksi Tanaman Sawi (*Brassica juncea* L.) Dengan Aplikasi Beberapa Konsentrasi Nutrisi AB Mix dan Monosodium Glutamat pada Sistem Tanam Hidroponik Wick. *Agrium: Jurnal Ilmu Pertanian*; *22*(1), 56–61.

**Article History:**
*Received*: 29 May 2023
*Revised*: 14 September 2024
*Available online*: 23 September 2024
*Published*: 30 September 2024

**Authors:**
Annisa Ulfa Luthfiyah, Department of Biology Educational, Faculty of Teacher Training and Education, Muhammadiyah Prof. Dr. Hamka University, Jakarta, Jalan Tanah Merdeka Jakarta Timur 13830, Indonesia, aulfa430@gmail.com
Ranti An Nisaa, Department of Biology Educational, Faculty of Teacher Training and Education, Muhammadiyah Prof. Dr. Hamka University, Jakarta, Jalan Tanah Merdeka Jakarta Timur 13830, Indonesia, ranti.anisa@uhamka.ac.id
Maryanti Setyaningsih, Department of Biology Educational, Faculty of Teacher Training and Education, Muhammadiyah Prof. Dr. Hamka University, Jakarta, Jalan Tanah Merdeka Jakarta Timur 13830, Indonesia, maryanti@uhamka.ac.id
Devi Anugrah, Department of Biology Educational, Faculty of Teacher Training and Education, Muhammadiyah Prof. Dr. Hamka University, Jakarta, Jalan Tanah Merdeka Jakarta Timur 13830, Indonesia, devi.anugerah@uhamka.ac.id

**How to cite this article:**
Luthfiyah AU, Nisaa RA, Setyaningsih M, Anugrah D. 2024. Effectiveness of LOF Mixture from Banana Peel with Rice Wash Water and Goat Manure on The Growth of Hydroponic *Brassica juncea*. LenteraBio; 13(3): 485-491.