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Pakcoy *(Brassica chinensis L.)* Growth Using Moringa Leaf Extract with the Addition of Red Onion Skin

Dwi Putri Widjaya*, Suparti
Biology Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta.
Jl. A. Yani Tromol Pos I, Pabelan, Kartasura, Surakarta 57162, Jawa Tengah, Indonesia
*Corresponding Author. E-mail address: dwiputriiwidjaya@gmail.com

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ABSTRACT

Pakcoy is a vegetable that contains carbohydrates, fat, Fe, P, Ca, vitamins A, B, C, E, and K. moringa leaves and shallot skin are one of the organic wastes that can be used as additional media for plants. The purpose of the research is to identify the effect of moringa leaf extract and shallot skin on the growth of pakcoy plants. This research used a CRD (completely randomized design) with 1 factor 4 repetitions. The factors used were extract of moringa leaved and shallot skin which included P0=0% concentration, P1=20% extract concentration, P2=40% extract concentration, P3=60% extrac concentration. Parameters observed wre plant height and number of leaves. Data were examined with the non-parametric Statistical test, namely the Kruskal Wallis and continued with Duncan's Multiple Range Test to determine the best growth and yield in that treadment. The results of data analysis showed that the best treatment. The results of data analysis showed that the best treatment for pakcoy growth was in treatment P1 with an average plant height of 7.725 cm and average number of leaves of 2.5 leaves. The lowest treatment of pakcoy growth was in treatment P3 with an average plant height of 4.875cm and average number of leaves of 0.25.

1. INTRODUCTION

Pakcoy is a horticultural plant whose leaves are used as vegetables. Cultivation of pakcoy plants is not only easy to carry out, but also produces fast results due to the short life span from planting to harvesting. Pakcoy plants have a very fast growth and harvest period of 30-45 days. The planting process is easy after the seeds of 3-4 leafy plants or 15 days old, the seeds are moved insidepoly bag (Putri et al. 2022). Plant growth and development certainly requires soil nutrients as nutrients. The availability of macronutrients and micronutrients has a significant impact on the growth of pakcoy plants; if soil nutrient availability is not maximum, fertilization is required. According to research results (Erawan and Bahrun 2013).

People of all ages, from children to the elderly, are very interested in eating pakcoy because it contains a lot of nutrients which are beneficial for your health, including protein, fat, carbs, calcium, iron, and vitamins A, B, C, and E. The nutritional content in pakcoy is very good, especially for pregnant women because it can prevent anemia. In addition, pakcoy can ward off hypertension, heart disease, and reduce the risk of various types of cancer (Pracaya 2016).

Fertilizers are nutrients that are added to growing plants to get the nutrient needs needed by plants so they can produce well. Fertilizers can be categorized as either organic or inorganic depending on where the raw materials came from (rice novita 2015). Vegetable farmers generally use inorganic fertilizers. The use of inorganic fertilizers can increase the content of macronutrients

in the soil, but their continuous use can cause adverse side effects. For example, the effectiveness of using urea fertilizer does not last long, because urea fertilizer that is used continuously and used in excessive doses can cause soil nitrate contamination (Triyono et al. 2013).

Organic fertilizer can be classified into two categories based on the form: liquid fertilizer and solid fertilizer. A liquid fertilizer is a soluble solution that contains one or more carrier elements required by plants. The benefits of liquid organic fertilizers are overcoming the shortage of organic matter in the soil, improving the physical, chemical and biological properties of the soil and being able to reduce the use of inorganic fertilizers. cause wilting and death symptoms in plants (Waluyo, 2020) Liquid fertilizer is generally made from a mixture of plant waste and organic matter containing plant growth support substances, such as Moringa leaves as a mixture for making liquid fertilizer.

The time and dose or concentration of liquid fertilizer application to plants must also be considered to avoid excess or deficiency of nutrients in plants. Research result (Suhastyo and Raditya 2019) showed that MOL of Moringa leaves on pagoda mustard (*Brassica narinosa*) was significantly different in the mustard plant's height, namely in the treatment of the frequency of giving 70 ml MOL of Moringa leaves once every 6 days. In the administration of 50 ml and 70 ml Moringa leaf MOL, there was no discernible variation in the number of leaves of the pagoda mustard plant.

Moringa Plant (*Moringa oleifera*) is a vegetable plant that has good nutritional content, including vitamin C and chlorophyll, and can grow in the lowlands and highlands up to ± 1000 meters over sea level (Fajri, Rahmatu, Rostiati 2018). Moringa plants are widely known in Indonesia, but have not been used optimally. Moringa is a plant that has almost complete macro elements and amino acids. Moringa leaf extract is an effective way to organically speed up plant growth. This is because Moringa leaves are rich in zeatin, cytokinins, ascorbate, phenolics, and minerals that can stimulate plant development including Ca, K, and Fe. Cytokinins are plant hormones that induce cell division, growth, and promote new cell growth and delay cell aging (Suhastyo and Raditya 2021). The amount of moringa leaf extract added to liquid organic fertilizer, up to 40%, impacts the growth of pakchoy plants, including the number of leaves, plant length, wet weight, and dry weight (Kartika 2014).

Shallot waste extract can be used as one of the nutrients that can be applied to plants. Onion skin contains growth hormones in the form of auxin and gibberellin hormones which can stimulate plant growth.

Onion skin contains protein, minerals, sulfur, anthocyanins, kaempferol, carbohydrates, and fiber. These elements are nutrients needed for plant growth. One of the substances contained in shallot skin is sulfur. Sulfur is one of the compounds needed by plants, it is absorbed as sulfate ion and undergoes reduction in plants to become a sulfhydryl group (Hanum et al. 2021).

According to the context, the purpose of the research is to identify the effect of moringa leaf extract and shallot skin on the growth of pakcoy plants.

2. MATERIALS AND METHODS

2.1. Location and Time

Research on the manufacture of liquid organic fertilizer and testing on plants was conducted at the Green House Laboratory of the Teaching and Education Faculty, Muhammadiyah University, Surakarta. This research was conducted in March – April 2023.

2.1.1. Tools and Materials

This study's instruments included poly bag, rockwoll, toothpicks, shovels, filters, stirrers, containers for holding solutions, lids, scissors, measuring cups, buckets/basins, trays, knives, stationery, rulers, paper labels, documentation tools, TDS meters, pH sticks. The materials used are soil, moringa leaves, shallot skin, pakcoy seeds, brown sugar, distilled water.

2.1.1.1. Research Prosedure

Making POC of Moringa leaves and shallot skin.

Shallot skins were taken from the production house "Brambang Goreng Jawa SW" in Colomadu District, Karanganyar Regency, Central Java. Moringa leaves were taken from a garden in Siwal village, Baki, Sukoharjo Regency.

Prepare other ingredients, namely brown sugar and distilled water. The next step is to make extracts of Moringa leaves and shallots by means of 1000g of shallot skin and 1000g of Moringa leaves, each of which is mashed with 1 liter of water. Then add 3 crushed brown sugar seeds and stir until all the ingredients are mixed. The mixture of shallot skin extract and Moringa leaves was placed in a tightly closed bucket and allowed to stand for 15 days, once every 2 days the Moringa leaf extract and onion skin were homogenized. After being left for 15 days, the solution was filtered using a funnel to obtain a filtrate. This solution is used as a stock solution with a concentration of 100%. For the treatment of the concentration of organic liquid fertilizer for Moringa leaves and shallots, it is sufficient to dilute the stock solution according to the required treatment.

Seeding

Nursery preparation begins with preparing nursery tools such as trays,cutter, and a toothpick. Materials used for nursery craterockwoll, and pakcoy seeds. Then choose the seeds to be sown and soak them in water for ± 12 hours, then cut themrockwoll 5×5 cm. Put it downrockwoll on a tray that has been filled with water as much as half a tray, make a holerockwoll with a toothpick to place the soaked pakcoy seeds. Sow the pakcoy seeds on rockwool for 15 days.

Planting

After 15 days or if the leaves have 4 strands, the pakcoy can be transferred to the planting medium.

Fertilizer Application

The treatment of giving liquid organic fertilizer by pouring 70 ml on the plants with a predetermined concentration. Provision of liquid organic fertilizer after the seedlings are 2 weeks old after planting with fertilization intervals every 6 days.

This research is quantitative experimental study. The design adopted in this research was a CRD (completely randomized design), with one experimental factor, especially the concentration of organic liquid fertilizer for moringa leaves and shallot skins, with four repetitions. The concentrations given are as follows; Concentration of 0% (P0) with no application of organic liquid fertilizer, concentration of 20% (P1) by means of dilution, take 200 ml of organic liquid fertilizer for moringa leaves and shallots plus 800 ml of distilled water, 40% concentration (P2) by means of dilution, take organic fertilizer 400 ml liquid moringa leaves and shallots plus 600 ml of distilled

water, a concentration of 60% (P3) by dilution method, 600 ml of organic liquid fertilizer for moringa leaves and shallots plus 400 ml of distilled water is taken.

The data of this study is the result of observing the height of the pakcoy plants which were observed at 14, 21 and 28 days after planting. The data obtained was processed using the Non-parametric Statistical data analysis technique, namely the Kruskal Wallis test and continued with Duncan's Multiple Range Test to find out the best growth and results in the treatment and then presented in graphical form.

3. RESULTS AND DISCUSSION

3.1.Result

Pakcoy plant growth was observed by measuring the height and calculating how many leaves there are once a week on the 14th, 21st, and 28th days after planting. Pakcoy plant height measurement starts from the base of the plant to the tallest leaf. This is in accordance with research **(Ningsi 2019)** which states that the measurement of plant height starts from the base of the plant to the highest point that can be reached by plant leaves by closing the plant leaves, measurements are made using a meter. While the observation of the number of leaves is completed by calculating how many leaves are on the plant. This is in accordance with research **(Jayanti 2018)** which states that the measurement of the number of leaves is done by calculating how many leaves that have opened perfectly.

Tabel 1. *Tes Statistics* (Kruskal Wallis Test)

	Plant height	**Number of leaves**
Asymp. Sig.	.015	.021

Based on the comparison of probability values (Asymp. Sig)

- If probability (Asymp. Sig) > 0.05, maha H0 is accepted
- If probability (Asymp. Sig) < 0.05, maha H0 is rejected

From the Statistics Test table above, the probability values (asymp. Sig) = 0.015 (plant height) and 0.021 (number of leaves). Result result :

From the output it can be seen that the probability values (Asymp. Sig.) are 0.015 < 0.05 and 0.021 < 0.05, so H0 is rejected, meaning there is a difference in the average plant height and number of leaves.

According to the analysis of variability findings, Table 2 displays that there was no discernible difference in fertilizer content according to plant height.

Tabel 2. Duncan's multiple range test results on growth of Pakcoy plant height

Pakcoy plant height Duncan				
extract concentration of moringa leaved and shallot skin	**N**	**Subset for alpha = 0.05**		
		1	**2**	**3**
P0 = extract concentration of moringa leaved and shallot skin 0%	4	2.800		
P3 = extract concentration of moringa leaved and shallot skin 60%	4	4.875	4.875	

Pakcoy plant height Duncan				
P2 = extract concentration of moringa leaved and shallot skin 40%	4		6.350	6.350
P1 = extract concentration of moringa leaved and shallot skin 20%	4			7.725
Sig.		.076	.192	.222

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 4.000.

The average values of P1 and P2 were not significantly different because they were in the same subset, namely subset 3, while there were significant differences in P0 and P1.

The analysis of variance data revealed a significant difference between fertilizer concentration and leaf count, as shown in Table 3.

Table 3. Duncan's multiple range test results Number of leaves of Pakcoy plant

Number of leaves of Pakcoy plant Duncan			
extract concentration of moringa leaved and shallot skin	**N**	**Subset for alpha = 0.05**	
		1	**2**
P0 = extract concentration of moringa leaved and shallot skin 0%	4	.25	
P3 = extract concentration of moringa leaved and shallot skin h 60%	4	.25	
P2 = extract concentration of moringa leaved and shallot skin 40%	4	1.00	
P1 = extract concentration of moringa leaved and shallot skin 20%	4		2.50
Sig.		.195	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 4.000.

The mean values of P0, P3, and P2 were not significantly different because they were in the same subset, namely subset 1, while the mean values of P2 were significantly different from P1 because they were in different subsets.

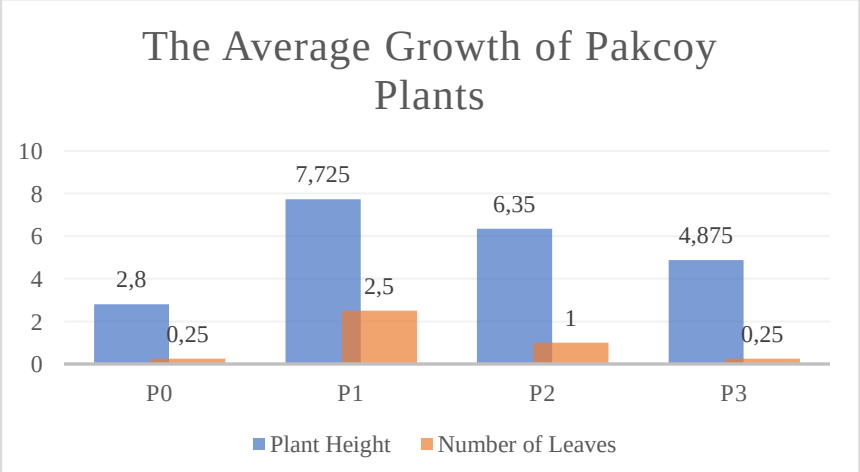

Figure 1. Histogram of the average growth of Pakcoy Plants

3.2.Discussion

The impact of the concentration of organic liquid fertilizer on Moringa leaves and shallot skin on plant height is presented in table 2, and Figure 1. It appears that the organic liquid fertilizer of Moringa leaves and shallot skin had no significant effect on the height of pakchoy plants in all treatments. The treatment that produced the best plant height was in treatment P1 with a dose of liquid organic fertilizer for Moringa leaves and shallots 20%, getting the highest average of 7,725 cm. These results indicate that applying liquid organic fertilizer to Moringa leaves and shallots with a concentration of 20% to the planting medium can increase the height of the pakcoy plants. This is because Moringa leaf extract contains cytokinin which is a hormone that accelerates plant growth, this is in accordance with research (Suhastyo and Raditya 2021) which states that moringa leaf extract can be applied to speed up plant growth naturally. This is because Moringa leaves are rich in cytokinins. In addition, shallot skin also contains auxin which is a hormone that has an impact in encouraging cell elongation, cell division, differentiation of xylem and phloem tissues. This is consistent with the findings (Hanum et al. 2021) which states that one of the aspect that can impact the increase in plant height is the hormone auxin which has a function to stimulate the elongation of stem cells.

The lowest plant height was found in treatment P3 with a dose of organic liquid fertilizer for Moringa leaves and 60% shallot skin, obtaining an average pakcoy plant height of 4.875 cm. This shows that the use of organic matter as liquid fertilizer will be effective in increasing plant growth if it is at the right dosage or concentration. Excessive dosage or concentration of fertilizer will be toxic to plants. Fertilizer application with low concentrations will not meet the needs of nutrients for plants, causing inhibition of plant growth. This is consistent with the findings (Hidayah et al. 2022) which states that at a higher concentration of shallot skin liquid organic fertilizer, the availability of nutrients and minerals for plants exceeds the adequacy limit, so it is not effective in supporting better growth, but on the contrary inhibits plant growth.

(a) (b)

Figure 2. The best plant height (a) and the lowest plant height (b)

Based on table 3 and figure 1, it can be seen that liquid organic fertilizer for moringa leaves and shallots had no discernible impact on the number of leaves of the pakcoy plant in all treatments. The treatment that produced the best number of leaves was in treatment P1 (20% organic liquid fertilizer for moringa leaves and shallot skin) with an average number of leaves of 2.5 strands. This is as a result of growth regulators in shallot skin extract, one of which is the hormone gibberellin. This is supported by research (Firdausi 2019) the presence of growth regulators such as gibberellins which are sufficient to encourage plant growth, especially in the formation of leaves.

In the therapy treatment P3, the fewest leaves were discovered (60% organic liquid fertilizer for moringa leaves and shallot skin) with an average number of leaves of 0.25 leaves. Fertilizer concentrations that are too high make plant growth less than optimal, so the growth of the number of leaves is also slow, which means the number of leaves will be less. In addition, plant height will also affect the number of leaves. The P3 treatment obtained the lowest average on the plant height parameter, so that the number of leaves parameter also obtained the lowest results. This is supported by research (Siregar 2018) which states that the increase in plant height indirectly affects the rise in leaf count, the higher the plant, the number of leaves will increase because the number of segments and the appearance of new shoots always produce new leaves.

One of the factors that influence leaf formation is the availability of nitrogen and phosphorus nutrients. Based on research (Banu 2020) Shallot skin extract contains nutrients contained in the shallot skin for example K, Mg, P, and Fe which can be used as organic liquid fertilizer that fertilizes plants. Whereas as a Growth Regulatory Substance (ZPT) in shallot skin there are hormones auxin and gibberellin which are growth hormones so that shallot skin might be utilized as a growth controller.

Figure 3. Treatment P1 (highest number of leaves) and P3 (least number of leaves)

One of the aspect that influence the growth and development of plants is the preparation of planting media, in this case the provision of nutrients in the form of fertilizers (nutrients) that are appropriate to the media. Provision of moringa leaf extract and shallot skin can meet the nutritional needs of the pakcoy plant (*Brassica chinensis* L.) because it contains flavonoids which can

stimulate the growth of pakcoy plants. This is in accordance with research (Prabowo and Noer 2020) which stated that shallot skins tested positive for containing alkaloid compounds, saponins, flavonoids and tannins. The function of flavonoids in plants in general is as a growth regulator, photosynthetic regulator, anti-microbial and anti-viral work. In addition, according to research (Tri Akbar et al. 2019) Moringa leaf mixture in fertilizer can be used by spraying it on the leaves to accelerate plant growth because it contains chemical compounds such as calcium, magnesium, phosphorus, iron and sulfur so that Moringa leaves can be used to make organic fertilizer ca.

Utilization of shallot skin as liquid organic fertilizer can reduce planting costs. Shallot waste extract contains nutritional elements needed for plant growth such as protein, minerals, sulfur, anthocyanin, kaempferol, carbohydrates, and fiber. These elements are nutrients needed for plant growth. Based on research (Yikwa and Banu 2020) states that shallot skin extract contains calcium (Ca) which is a nutrient needed by plants in addition to nitrogen, phosphorus, potassium, magnesium and sulfur.

4. CONCLUSIONS

Liquid organic fertilizers for Moringa leaves and shallot skins can be used as alternative hormones for plant growth. The implementation of organic liquid fertilizer for Moringa leaves and shallot skins affects the height and number of leaves of the pakcoy plant.

Applying organic liquid fertilizer for Moringa leaves and shallot skins with a concentration of 20% gives the best growth of pakcoy plants. Meanwhile, the implementation of organic liquid fertilizer for Moringa leaves and shallots with a concentration of 60% gave the lowest growth of pakcoy plants.

The concentration of organic liquid fertilizer for Moringa leaves and shallot skins 200 ml/l water is the best concentration, but this result is not an optimal concentration, because the concentration of 20% is the concentration at the lowest level in this experiment. So that further study is needed to identify the concentration of organic liquid fertilizer with a lower or higher concentration level which will produce a truly optimum concentration for growth and number of leaves. Researchers hope that further research can add other parameters so that the effect given by liquid organic fertilizer of Moringa leaves and shallot peels is more maximal on plant growth.

5. REFERENCES

Banu, L. S. 2020. Review: Pemanfaatan Limbah Kulit Bawang Merah dan Ampas Kelapa sebagai Pupuk Organik terhadap Pertumbuhan Beberapa Tanaman Sayuran. *Jurnal Ilmiah Respati* 11(2): 148–155. DOI: 10.52643/jir.v11i2.1125

Erawan, D., and Bahrun, A. 2013. Pertumbuhan dan Hasil Tanaman Sawi (Brassica juncea L.) pada Berbagai Dosis Pupuk Urea. *Jurnal Agroteknos* 3(1): 19–25.

Fajri, Rahmatu, Rostiati, N. A. 2018. Kadar Klorofil Dan Vitamin C Daun Kelor (Moringa oleifera Lam) dari Berbagai Ketinggian Tempat Tumbuh Chlorophyll and Vitamin C Levels of Moringa Leaf (Moringa Oleifera Lam) Growingon Various Altitudes. *J. Agrotekbis* 6(2): 152–158.

Firdausi, a. A. (2019). *Pengaruh Pemberian Ekstrak Umbi Bawang Merah (Allium cepa L) Terhadap Pertumbuhan Tanaman Baby Kailan (Brassica oleracea L)*. Lampung: Universitas Lampung.

Hanum, U. F., Rahayu, Y. S., and Ratnasari, E. 2021. Pengaruh Atonik dan Filtrat Kulit Bawang Merah Terhadap Pertumbuhan dan Produktivitas Tanaman Bunga Matahari (Helianthus annuus). *LenteraBio : Berkala Ilmiah Biologi* 9(1): 17–22. DOI: 10.26740/lenterabio.v9n1.p17-22

Hidayah, N. U. R., Corina, T., Ode, L. A., Agroteknologi, J., Pertanian, F., and Halu, U. 2022. Bawang Merah Terhadap Pertumbuhan Tanaman Kembang Kol (Brassica oleracea var . botrytis) The Effect of Concentration of Liquid Organic Fertilizer (POC) Shallot Skin on Growth Cauliflower (Brassica oleracea var . botrytis). *Jurnal Agroteknos* 12(2).

Jayanti, K. D. (2018). Perbandingan Pertumbuhan dan Hasil Ketimun Melalui Cara Aplikasi Pupuk Organik Cair yang Berbeda. *Jurnal AgroPet*, 20-25.

Kartika, Rahma Dewi. 2014. "Pengaruh Pupuk Organik Cair Daun Kelor (Moringa Oleifera, Lamk) Terhadap Pertumbuhan Tanaman Pakchoy (*Brassica Rapa, L*.) yang ditanam Secara Hidroponik dan Sumbangannya Pada Pembelajaran Biologi di SMA". *Naskah Publikasi. Universitas Sumatera Utara.*

Ningsi, B. P. dan S. 2019. Peranan Pupuk Kotoran Kambing Terhadap Tinggi Tanaman, Jumlah Daun, Lebar dan Luas daun Total Pennisitum purpureum cv. Mott. *STOCK Peternakan* 2(2): 11–24.

Prabowo, A., and Noer, S. 2020. Uji kualitatif fitokimia kulit bawang merah (Allium ascalonicum). *Prosiding Seminar Naisonal Sains* 1(1): 250–253.

Pracaya., dan Juang Gema Kartika. (2016). Bertanan 8 Sayuran Organik. Jakarta : Penebar Swadaya.

Putri, Y. D. A., Kurniasih, S., and Munarti, . 2022. Efektivitas Kulit Bawang Merah (*Allium ascalonicum*) Terhadap Pertumbuhan Pakcoy (*Brassica rapa*). *Ekologia* 21(2): 44–53. DOI: 10.33751/ekologia.v21i2.3635

rice novita, novita sari. 2015. Analisis Dan Perancangan Berorientasi Obyek. *Teknoif* 3(2): 1–6.

Siregar, D. A. 2018. Pemanfaatan Ekstrak Bawang Merah (Allium cepa L.) Terhadap Viabilitas Benih Kakao (Theobroma kakao L.). *Jurnal Education and Development* 3(2): 23.

Suhastyo, A. A., and Raditya, F. T. 2019. Respon Pertumbuhan dan Hasil Sawi Pagoda (Brassica Narinosa) terhadap Pemberian Mol Daun Kelor. *Agrotechnology Research Journal* 3(1): 56–60. DOI: 10.20961/agrotechresj.v3i1.29064

Suhastyo, A. A., and Raditya, F. T. 2021. Pengaruh Pemberian Pupuk Cair Daun Kelor Dan Cangkang Telur Terhadap Pertumbuhan Sawi Samhong (Brassica juncea L.). *Jurnal AGROSAINS dan TEKNOLOGI* 6(1): 1. DOI: 10.24853/jat.6.1.1-6

Tri Akbar, C., Suketi, K., and Gema Kartika, J. 2019. Panen dan Pascapanen Kelor (Moringa oleifera Lam.) Organik di Kebun Organik Kelorina, Blora, Jawa Tengah. *Buletin Agrohorti* 7(3): 247–254. DOI: 10.29244/agrob.v7i3.30171

Triyono, A., Purwanto, and Budiyono. 2013. Efisiensi Penggunaan Pupuk – N untuk Pengurangan Kehilangan Nitrat pada Lahan Pertanian. *Prosiding Seminar Nasional Pengelolaan Sumber Daya Alam dan Lingkungan* (1): 526–531.

Tri Waluyo. (2020). "Analisis Finansial Aplikasi Dosis Dan Jenis Pupuk Organik Cair Terhadap Produksi Tanaman Tomat (Lycopersicum Esculentum Mill)". *Jurnal Ilmu Budaya.* 8357-8370.

Yikwa, P., and Banu, L. S. 2020. Respon Polikultur Cabai Rawit Dan Sawi Terhadap Waktu Pengomposan Dan Dosis Kompos Kulit Bawang Merah. *Jurnal Ilmiah Respati* 11(1): 46–61. DOI: 10.52643/jir.v11i1.850.