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Effect of Banana Bark and Cow's Blood Meal Compost on the Green Lettuce Plants (*Lactuca sativa* L.) Growth

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ABSTRACT

Green lettuce (*Lactuca sativa* L.) is a vegetable crop that is in great demand by the public, but its production is relatively low so that it cannot meet the high market demand. One of the efforts to increase the production of green lettuce plants is by applying organic fertilizer. The purpose of this study was to determine the content of C, N, P, K elements, the effect of compost application for growth and optimal dosage. The research method used a complete randomized design (CRD) four treatments namely Control, A (dose of 60 g), B (dose of 120 g) and C (dose of 180 g) with 5 replications. Data from the study were analyzed using the Anova test, significant data continued with the DMRT 5% further test. Testing the effect with simple liner regression analysis. The results showed that compost gave a blackish brown color after 35 days and had no odor and obtained nutrient values of C (41,77%), N (6,92%), P (0,09%) and K (0,12%). The treatment of compost variations produced plant height of 26,80 cm, number of leaves of 10,60 leaf, plant wet weight of 22,40 gram, root weight of 0,57 gram, root length of 12,94 cm leaf area of 130,06 cm² with significant results, while chlorophyll A (0,19 mg/L) and total (0,616 mg/L) levels had insignificant results. The conclusion of the research is that the compost of banana stalks and cow blood meal contains C by 41,77%, Total N by 6,92%, Total P by 0,09% and Total K by 0,12%. Banana pith compost and cow blood flour had a significant effect on all parameters of green lettuce plant growth except leaf chlorophyll content at the most optimal dose was treatment A (dose of 60 g).

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1. Introduction

Compost is a solid organic fertilizer. The application of compost to plants can overcome the problem of soil degradation by affecting the physical and microbial properties of the soil and supplying nutrients to plants (Murnita and Taher, 2021). Knowledge about organic fertilizers has been around for a long time, but many farmers have switched to using inorganic fertilizers because they are more practical, easy to obtain and relatively cheap. The constant use of inorganic fertilizers over a long period of time without the use of organic fertilizers has a negative impact on the soil because it makes the nutrient content unbalanced, the nutrients absorbed become less than optimal, and the microbes contained in the soil become low (Marjannah et al., 2017). Therefore, the use of organic materials can help overcome the problems caused by the use of inorganic fertilizers. Organic materials that have potential as compost raw materials are banana pith and cow blood.

Banana pith is the waste from banana plants. Banana pits contain nutrients consisting of NO_3 3.087 ppm, P_2O_5 439 ppm, NH_4 1.120 ppm and K2O 574 ppm (Suhastyo, 2011). The high macronutrients in banana pomace have the potential as organic material that provides plant nutrients, one of which is potassium (Bahtiar et al., 2016). Potassium is used by plants for the photosynthesis process and increases defense against disease (Imas et al., 2017). Another material used for composting is cow's blood. Cow blood is obtained from slaughterhouses. Based on the total body weight, cows contain about 3,5-7% blood (Lianis et al., 2017). Nutrients in cow blood, especially N, are quite large, namely N 13,25%, P 1% and K 0,6% (Jamila, 2012).

Green lettuce (*Lactuca sativa* L.) is a vegetable crop that has high economic value. Lettuce cultivation activities have not been widely developed so that production is still low and cannot meet high market demand (Laksono & Nurlenawati, 2021). According to data from the Central Bureau of Statistics (2017), the productivity of lettuce plants is only 627.611 tons while the demand is much higher at 711.004 tons. Based on this, it is necessary to carry out developments that can increase green lettuce production.

There have been many previous studies conducted using banana stump or cow's blood to be applied to plants. Sweet corn (Bahtiar et al., 2016), tomatoes (Rohmandoni, 2021), and oil palm (Muslim, 2018) which showed an effect on growth parameters. Therefore, this study was conducted to determine the effect of banana stump compost combined with cow blood meal on the growth of green lettuce plants. This research contributes to the provision and determination of the optimal dose of the combination of banana pith compost and cow's blood meal in vegetable crops, especially green lettuce.

2. Methods

2.1. Tools and Materials

The tools used for this research are stove, pot, stirrer, sieve, mortar, sieve, analytical balance, polybag, test tube, UV-Vis spectrophotometer, beaker, measuring pipette, propipette, cuvette and camera. The materials used for this research are banana stump, cow blood, bran, husk charcoal, EM_4, sugar, universal pH, 70% alcohol filter paper, 50 ml distilled water, labels, and tissue.

2.2. Research Design

This research is an experimental study using a one-factor completely randomized design (CRD) with 4 treatments and 5 repetitions (Federer formula, 1999). The treatments consisted of K (no treatment), treatment A (60 gram), treatment B (120 gram) and treatment C (180 gram).

2.3. Procedures

Composting: Banana bark that has been cut into small pieces and cow blood meal are mixed with bran in a ratio of 4:4:1, then stirred until evenly distributed. All the materials were made into a mound that was covered with a tarpaulin and covered again with a tarpaulin. The compost is stirred and the temperature is checked every day.

Seeding and Planting: Before sowing, green lettuce seeds were first soaked in warm water at 50°C for 5 hours to break dormancy, then the seeds were sown in 15x20 cm polybags by sowing. After 14 days after seed, the seedlings were transferred to new media.

2.4. Observation

Plant height: Plant height was measured from the base of the soil surface to the tip of the longest leaf at 7, 14, 21, 28 and 35 days after planting.

Number of Leaves: Leaves were counted from the tip to the base of the stem at 7, 14, 21, 28 and 35 days after planting.

Wet weight: Plants were weighed at 35 days after transplanting.

Root Weight: The roots are first separated from the green lettuce plants and then weighed on a scale at harvest time.

Root Length: The root is measured one of its longest parts at harvest time

Leaf Area: Leaf area was measured using the gravimetric method. Leaf area was calculated using the formula

$$\frac{duplication\ weight\ (BR)}{paper\ sheet\ weight\ (BK)}\ x\ paper\ sheet\ area\ (LK)$$

Chlorophyll: Chlorophyll content was measured using the spectrophotometric method.

3. Results and Discussion

3.1. Compost Content Analysis

The process of decomposing compost converts compounds that are still in the form of organic compounds into inorganic compounds/elements that can be absorbed by plants. At the beginning of composting, the odor released is slightly pungent, while at the end of composting there is no longer any odor released by the compost. Odorless compost indicates that the compost is mature. This is in line with Mulyono's (2014) statement, one of the ways to ensure that compost is ready to harvest is that it does not smell or have a smell like soil odor.

The color of the compost is initially reddish brown, as the composting process progresses, the compost eventually changes color to blackish brown. The color change also shows the characteristics of composting that goes well and the compost has matured. According to Suryati (2014), mature compost is characterized by a change in color to brown tending to blackish. The color change of compost can be seen in Figure 1.

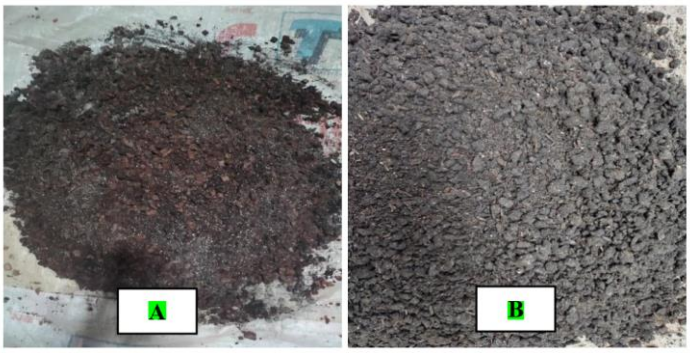

Figure 1. Color change of compost (A: beginning, B: end)

Tests of C, N, P, K were carried out to determine how much nutrients are contained in banana stump compost and cow blood flour. The results of compost nutrient analysis can be seen in Table 1. Based on the results of laboratory analysis of banana stump compost and cow blood flour (Table 1), the C-organic element is 41,77%. C-organic content during the composting process will decrease because it is influenced by microbial activity to be used as an energy source and others will be released in the form of CO_2 (Bachtiar, 2016). N-Total analysis resulted in a value of 6,92%.

Table 1. Results of nutrient analysis of banana stump compost and sapi blood meal

Component	Amount
C-Organic	41,77%
N Total	6,92%
P Total	0,09%
K Total	0,12%

The increase in nitrogen during the decomposition process is caused by microbial activity that converts ammonia into nitrite (NO_2^-) (Ratna et al., 2017). Nitrogen plays an important role for plants for the photosynthesis process (Hajama, 2014). P-Total analysis resulted in a value of 0,09%. Phosphorus elements are mostly used by microbes for metabolic processes. This is supported by the statement of Suswardany et al. (2006), which states that during the composting process half of the phosphorus element is used by microbes to make egg white substances in their bodies. And the K - Total analysis showed a value of 0,12%. The low K-Total result is due to the factor of stirring the compost too often so that the potassium content decreases. According to Maesaroh et al. (2014), the

length of time stirring affects the potassium element produced because the potassium element that has been bound can be released again.

3.2. Vegetative growth parameters

The growth of green lettuce plants (*Lactuca sativa* L.) observed was vegetative growth, including plant height (cm), number of leaves (leaf), plant wet weight (g), root weight (g), root length (cm), leaf area (cm^2) and chlorophyll levels (mg/L). Organic fertilizers contain macro nutrients N, P, K which play an important role during plant growth and development (Lingga and Marsono, 2013). The following presents the results of the mean difference test of the growth parameters of green lettuce plants as listed in Table 2.

Table 2. Mean difference test results for all growth parameters of green lettuce plants (*Lactuca sativa* L.)

Treatment	Measurement result						
	Plant Height (cm)	Number of Leaves (leaf)	Wet Weight (g)	Root Weight (g)	Root Length (cm)	Leaf Area (cm^2)	Chlorophyll A
K	23,08±0,83^{a}	9,80±0.83^{ab}	15,60±2,70^{b}	0,37±0,10^{ab}	10,92±1,44^{b}	94,57±17,11^{a}	0,149±0,54^{a}
A	26,80±2,96^{b}	10,60±1,14^{b}	22,40±3,84^{c}	0,57±0,27^{b}	12,94±0,93^{c}	130,06±29,41^{b}	0,19±0,10^{a}
B	21,16±2,60a	9,00±0,44^{a}	11,20±2,70^{a}	0,19±0,07^{a}	8,92±0,99^{a}	84,15±12,88^{a}	0,165±0,12^{a}
C	20,86±2,07^{a}	8,80±0,70^{a}	8,60±2,77^{a}	0,18±0,04^{a}	8,04±1,46^{a}	69,97±13,60^{a}	0,163±0,08^{a}

Note: K= control (no treatment); A = dose of 60 gram; B = dose of 120 gram; C = dose of 180 gram
a-b-c: The same letter notation indicates that there is no significant difference based on the 5% DMRT test level.

During the growth, plants require nitrogen in large quantities, nitrogen as the formation of chlorophyll and as a form of chlorophyll and nucleic acid has an important role in cell division and elongation so as to increase the height of the plants obtained (Rohmandoni, 2021). Organic matter containing the appropriate nitrogen element has a significant effect on the growth of plant height and branches (Pamungkas and Supijatno, 2017). Based on Table 2, all growth parameters treated with treatment A (60 gram compost) showed the best results. Plant height produced the highest average of 26,80 cm. This means that plants can absorb nutrients well. According to Fajarditta et al. (2012), the amount of dosage affects the absorption of nutrients by plants. The element that plays a role in increasing plant growth is nitrogen. Nitrogen is absorbed in the form of nitrate ions (NO_3^-). Nitrate is captured by root hairs during the process of anion respiration and collected in vacuoles which are later broken down into ammonia (NH_3) for use by plants (Lusiana, 2015). Nitrogen functions in the formation of proteins so that metabolic processes can run and spur cells to divide and elongate, so that the stem can increase in height (Sayekti et al., 2016).

The number of leaves produced the highest average of 10,60 leaves. The results showed that the lower the dose of compost given, the greater the average height of green lettuce plants. This means that lower doses can fulfill the need for nutrients for root absorption in the soil to the leaves. This is in line with the statement of Cahyono and Tripama (2015), the absorption of nutrients by plants is directly related to the number of leaves. Nitrogen plays a role in the process of leaf formation. Sufficient nitrogen elements will encourage vegetative growth of plants, one of which is the leaves, especially the formation of chlorophyll to carry out photosynthesis (Haryadi et al., 2015). Chlorophyll is used for the photosynthesis process so that if the N element is sufficient, chlorophyll can increase. The process of photosynthesis is influential because it produces carbohydrates that are used by plants for the process of increasing the number of leaves due to the process of division, increase and enlargement of cell size (Hartadi et al., 1997). The results of research by Gustina et al. (2021), showed that the treatment of liquid organic fertilizer with a combination of banana peel and stem at a concentration of 70 mL produced 11 curly lettuce leaves, more than the control.

Wet weight of plants produces the highest average of 22,40 g. The increase in wet weight is influenced by nutrients that are balanced and meet the needs of green lettuce plants so that it affects its vegetative growth, and can increase the availability of nutrients needed to form organic

compounds. According to Laksono (2014), nitrogen nutrient content plays an important role for metabolic processes because it is used for the formation of components such as proteins, enzymes, hormones and carbohydrates so that tissues can perform cell division for bud formation, root and leaf growth which will affect the wet weight of plants.

Root weight is influenced by nutrients and water content contained in the plant, because it is a determinant of the high and low weight of plant roots. Nutrients that play a role in determining the weight of plant roots are potassium (K) and phosphorus (P). The absorption of these elements into the plant roots is through the diffusion of high concentrations of nutrients to the root surface. The element K plays a role in increasing the growth and development of root branches by affecting the absorption capacity of plants (Ahmad et al., 2016). P element plays a role in the process of formation and existence of roots (Nurhaeni et al., 2020). Root weight produced the highest average of 0,57 g. This shows that the roots in treatment A have a good ability to absorb the nutrients needed so as to increase cell size. The absorption of these elements to the plant roots through diffusion events from high concentrations of nutrients to the root surface. Potassium plays a role in increasing the growth and development of root branches by affecting plant absorption (Ahmad et al., 2016). The highest increase in root weight was due to the good ability of the roots to absorb the nutrients needed so as to increase cell size, on the other hand, the decrease in wet weight was due to the provision of doses that were too high, which affected the decrease in the ability of the roots to absorb nutrients. The ability of the roots to absorb nutrients. According to Isrun (2010), loose soil is also influential because it allows the roots to develop well so that it affects the root weight. The increase in root wet weight is influenced by the physical properties of the soil. Another statement from Sertua et al. (2014), states that loose soil due to the provision of compost with organic materials can increase the value of root wet weight.

Root length is an important parameter related to the growth of other parts of the plant that illustrates the absorption of nutrients (Gardner et al., 1991). The length of plant roots is influenced by the nature of the soil media, so that the absorption of nutrients in the process of preparing complex compounds (assimilation) which will be used by the roots to stimulate better root growth (Muhadiansyah et al., 2016). Root length produced the highest average of 10,92 cm. The results show that the ability of plants to absorb nutrients in treatment A is better than other treatments. Root length is an important parameter related to the growth of other parts of the plant that illustrates the absorption of nutrients (Gardner et al., 1991). The ability of plants to absorb nutrients has an impact on the movement of ions from the roots to the meristem tissue so that it determines whether the metabolic process is going well or not. The nutrient that plays a role in root length increase is potassium (K), because it plays a role in the process of young tissue division and stimulates root formation (Ahmad et al., 2016). Potassium helps spread photosynthesis products from leaves to roots and stores energy for root growth. In addition, it also supports the running of metabolic processes and cell elongation (Satriawi, 2019). The element phosphorus (P) contained in compost is used by plants as a basic material for the manufacture of proteins and assimilates that form roots (Muhadiansyah et al., 2016).

Leaf area is an illustration of the total area of plant leaves. The growth of plant parts such as leaf area is related to the nutrient nitrogen (N). According to Kardin (2013), the availability of N affects the growth and expansion of the leaf surface. In addition to the element N, there is also the element potassium (K) which plays a role in influencing young tissue to continue to divide so that it affects the leaf area (Satria et al., 2015). Leaf area produced the highest average of 130,06 cm^2. The increase in the average produced by treatment A (dose of 60 g) is due to the dose of compost given according to the needs of green lettuce plants. This is in line with the opinion of Hariyanto (2006), the appropriate organic material can improve the chemical, physical and biological quality of the soil so that the roots can absorb nutrients well and spread them to all parts of the plant and produce the best vegetative growth. Fariudin et al. (2011) stated that the amount of leaf area value obtained indicates that the photosynthesis process runs smoothly and produces large amounts of chlorophyll.

Chlorophyll is the green substance of leaves. Leaf chlorophyll levels are influenced by the nutrient nitrogen (N). The element nitrogen (N) helps in the photosynthesis process in the leaves. The higher the solubility level of fertilizer, the easier it is to be absorbed by plant roots which has an impact on increasing the amount of chlorophyll produced (Ajiningrum, 2018). Chlorophyll A produced the highest average of 0,19 mg/L. Different results in all treatments are caused by

pigmentation factors in leaves that are not the same as each other and the influence of plant adaptation to the environment. Plant leaf area works to capture light for the photosynthesis process to affect the amount of leaf chlorophyll. This is in accordance with the opinion of Setiawati et al. (2016), stating that chlorophyll is influenced by the amount of pigmentation and leaf surface area. Leaf chlorophyll levels are influenced by the nutrient nitrogen (N). The element nitrogen (N) helps in the process of photosynthesis in the leaves. The higher the level of fertilizer solubility, the easier it is to be absorbed by plant roots, which has an impact on increasing the amount of chlorophyll produced (Ajiningrum, 2018).

Abiotic factors observed during the study included air temperature, humidity, sunlight intensity and soil pH. Favorable abiotic factors will produce ideal plant growth. The following are the results of abiotic measurements during the treatment period which were observed every day as shown in Table 3.

Tabel 3. Environmental abiotic observations and green lettuce growing media

No	Abiotic Parameters	Measurement Results
1	Air temperature (°C)	21-29
2	Air humidity (%)	75-91
3	Light intensity (Cd)	100-1500
4	soil pH	6-7

Based on observations in the artificial greenhouse environment, the meets the requirements for the growth of green lettuce plants. This is supported by the statement of Adimihardja et al. (2013), which states that lettuce plants grow well in the highlands at an altitude of 500-2000 meters above sea level. Lettuce plants grow well in the highlands at an altitude of 500-2000 meters above sea level, with air and soil humidity above 60%, soil pH between 6,5-7 and temperature between 15-25°C.

4. Conclusion

Based on the study of the results of this research, it can be concluded that banana stump compost and cow blood flour contain nutrients such as C by 41,77%, Total N by 6,92%, Total P by 0,09%, Total K by 0,12% and treatment A (dose of 60 gram) showed the highest results on the growth parameters of green lettuce plants including plant height, number of leaves, wet weight, root weight, root length, leaf area and leaf chlorophyll.

REFERENCES

Adimihardja, S.A., Hamid, G., dan Rosa, E. (2013). Pengaruh Pemberian Kombinasi Kompos Sapi dan Fertimix Terhadap Pertumbuhan dan Produksi Dua Kultivar Tanaman Selada (*Lactuca sativa* L.) dalam Sistem Hidroponik Rakit Apung. *Jurnal Pertanian*, 4(1):6-20.

Ahmad, F., Fathurrahman., dan Bahrudin. (2016). Pengaruh Media dan Interval Pemupukan Terhadap Vigor Cengkeh (*Syzygium aromaticum* L.). *e-Jurnal Mitra Sains*, 4(4):36-47.

Ajiningrum, P.S. (2018). Kadar Total Pigmen Klorofil Tanaman Avicennia marina pada Tingkat Perkembangan Daun yang Berbeda. *Stigma*, 11(2):52-59.

Bahtiar, S.A., Amir, M., Lutfi, U., Jefri, A., Cindy, P., dan Miswar. (2016). Pemanfaatan Kompos Bonggol Pisang (Musa acuminata) Untuk Meningkatkan Pertumbuhan dan Kandungan Gula Tanaman Jagung Manis (*Zea mays* L.). *Agritrop Jurnal Ilmu-Ilmu Pertanian*, 14(1):18-22.

BPS. (2017). *Statistik Tanaman Sayur dan Buah-Buahan Semusim*. Jakarta: Badan Pusat Statistik.

Cahyono, B.H. dan Tripama, B. (2014). Respons Tanaman Tomat Terhadap Pemberian Pupuk Bokashi dan Pengaturan Jarak Tanam. *Agritop Jurnal Ilmu-Ilmu Pertanian*, 12(2):168-187.

Fajarditta, F., Sumarsono, S., dan Kusmiyati, F. (2012). Serapan Unsur Hara Nitrogen dan Phospor Beberapa Tanaman Legum pada Jenis Tanah yang Berbeda. *Animal Agriculture Journal*, 1(2):41-50.

Fariudin, R,. Sulistyaningsih, E., dan Waluyo, S. (2011). *Pertumbuhan dan Hasil Dua Kultivar Selada* (*Lactuca sativa* L.) *dalam Akuaponika pada Kolam Gurami dan Kolam Nila*. Yogyakarta: Universitas Gadjah Mada.

Gardner, F.P., Pearce, R.B., dan Mitchell, R.L. (1991). *Fisiologi Tanaman Budidaya*. Jakarta: Universitas Indonesia Press.

Hajama. (2014). *Pemanfaatan Eceng Gondok Sebagai Bahan Pembuatan Pupuk Kompos dengan Menggunakan Aktivator EM4 dan MOL serta Prospek Pengembangannya*. Makassar: Universitas Hasanuddin.

Hariyanto. (2006). *Pengaruh Residu Herbisida Diuron dan Residu Pupuk Berkelanjutan Terhadap populasi Mikroorganisme pada Tanah Utisol Taman Bogo Lampung Timur*. Bandar Lampung: Universitas Lampung.

Hartadi, H.S., Reksohadiprodjo., dan Tilman, A.D. (1997). *Tabel Komposisi Pakan untuk Indonesia*. Yogyakarta: Universitas Gadjah Mada.

Haryadi, D., Yetti, H., dan Yoseva, S. (2015). Pengaruh Pemberian Beberapa Jenis Pupuk Terhadap Pertumbuhan dan Produksi Tanaman Kailan (*Brassica alboglabra* L.). *Jom faperta*, 2(2):99-102.

Imas, S., Damhuri., dan Asmawati, M. (2017). Pengaruh Pemberian Pupuk Kompos Terhadap Produktivitas Tanaman Cabai Merah (*Capsicum annuum* L.). *Jurnal AMPIBI*, 2(1):57-64.

Isrun. (2010). Perubahan Serapan Nitrogen Tanaman Jagung dan Kadar Al-dd Akibat Pemberian Kompos Tanaman Legum dan Non Legum pada Inseptisol Napu. *Jurnal Agroland*, 7(1):1-8.

Jamila. (2012). *Modul Pemanfaatan Darah dari Limbah RPH. Teknologi Pengelolaan Limbah dan Sisa Hasil Ternak*. Makassar: Universitas Hasanudin.

Kardin. (2013). *Teknologi Kompos*. Jawa Barat: Dinas Pertanian Tanaman Pangan.

Laksono, R.A. (2014). Pertumbuhan dan Hasil Tanaman Kubis Bunga Kultivar Orient F1 Akibat Jenis Mulsa dan Dosis Bokashi. *Jurnal Agrotek Indonesia*, 1(2):81-89.

Laksono, R.A. dan Nurlenawati, N. (2021). Uji Efektivitas Waktu Pemberian Nutrisi Terhadap Produksi Selada Hijau (*Lactuca sativa* L.) Varietas New Grand Rapids Pada Sistem Aeroponik. *Jurnal Ilmiah Pertanian*, 9(2):238-248.

Lianis, J.H., Zuhry, E., dan Yetti, H. (2017). Respon Tanaman Kedelai (*Glycine max*) yang Diberi Tepung Darah Sapi. *JOM Faperta*, 4(1):1-10.

Lingga, P. dan Marsono. (2013). *Petunjuk Penggunaan Pupuk*. Jakarta: Penebar Swadaya.

Lusiana. (2015). Pengaruh Berbagai Jenis Pupuk Organik Terhadap Pertumbuhan dan Hasil Tanaman Selada (*Lactuca sativa*) di Dataran Rendah. *Jurnal Agrorektan*, 2(2):102-116.

Maesaroh, S., Sedyawati, M.K.R., dan Mahatmanti, F.W. (2014). Pembuatan Pupuk K_2SO_4 dari Ekstrak Serabut Kelapa dan Air Kawah Item. *Indonesian Journal of Chemical Science*, 3(3):239-243.

Marjannah., S.J., dan Budi, S. (2017). Pengaruh Pemberian Jenis Pupuk Organik Terhadap Laju Pertumbuhan Tanaman Bawang Merah (*Allium cepa*). *Jurnal Jeumpa*, 4(1):11-20.

Muhadiansyah, T.O., Setyono., dan Adimihardja, A. (2016). Efektivitas Pencampuran Pupuk Organik Cair dalam Nutrisi Hidroponik pada Pertumbuhan dan Produksi Tanaman Selada (*Lactuca sativa* L.). *Jurnal Agronida*, 2(1):37-46.

Mulyono. (2014). *Membuat Mol dan Pupuk Kompos dari Sampah Rumah Tangga*. Jakarta: Agromedia Pustaka.

Murnita. dan Taher, Y.A. (2021). Dampak Pupuk Organik dan Anorganik Terhadap Perubahan Sifat Kimia Tanah dan Produksi Tanaman Padi (*Oryza sativa* L.). *Menara Ilmu*, 15(2):67-76.

Muslim, E. (2016). *Pengaruh Dosis Tepung Darah Sapi Terhadap Pertumbuhan dan Hasil Jagung Manis* (*Zea mays* saccharata Sturt.). Padang: Universitas Andalas.

Pamungkas, M.A., dan Supijatno. (2017). Pengaruh Pemupukan Nitrogen Terhadap Tinggi dan Percabangan Tanaman Teh (*Camelia sinensis*) untuk Pembentukan Bidang Petik. Bul. *Agronomi*, 5(2):234-241.

Ratna, D.A.P., Sumiyati, S., dan Samudro, G. (2017). Pengaruh Kadar Air dan Ukuran Bahan Terhadap Hasil Pengomposan Sampah Organik TPST. Jurnal Teknik Lingkungan, 6(2):66-70.

Rohmandoni, E. (2021). *Aplikasi Tepung Darah Sapi dan KCL Terhadap Pertumbuhan Tanaman Tomat* (*Lycopersicon esculentum* Mill.). Pekanbaru: Universitas Islam Riau.

Satria, N., Wardati, dan Khoiri, M.A. (2015). Pengaruh Pemberian Kompos Tandan Kosong Kelapa Sawit dan Pupuk NPK Terhadap Pertumbuhan Bibit Tanaman Gaharu (*Aquilaria malaccensis*). *JOM Faperta*, 2(1):1-14.

Sayekti, R.S., Prajitno, D., dan Indradewa, D. (2016). Pengaruh Pemanfaatan Pupuk Kandang dan Kompos Terhadap Pertumbuhan Kangkung (*Ipomea retans*) dan Lele Dumbo (*Clarias gariepinus*) pada Sistem Akuaponik. *Jurnal Teknologi Lingkungan*, 17(2):108-117.

Setiawati, T., Saragih, I.A., Nurzaman, M., dan Mutaqin. (2016). *Analisis Kadar Klorofil dan Luas Daun Lampeni (Ardisia humilis Thunbergh) pada Tingkat Perkembangan yang Berbeda di Cagar Alam Pengandaran*. Jatinangor: Universitas Padjajaran.

Suhastyo, A. A. (2011). *Studi Mikrobiologi dan Sifat Kimia Mikroorganisme Lokal yang Digunakan pada Budidaya Padi Metode SRI* (*System of Rice Intensification*). Bogor: Institut Pertanian Bogor.

Suryati, T. (2014). Bebas Sampah dari Rumah: *Cara Bijak Mengolah Sampah Menjadi Kompos dan Pupuk Cair*. Jakarta: AgroMedia Pustaka.

Suswardany, D.L., Ambarwati, dan Kusmawati. (2006). *Peran Effective Microorganism 4 (EM4) dalam Meningkatkan Kualitas Kimia Kompos Ampas Tahu*. Surakarta: Universitas Muhammadiyah Surakarta.