Utilization Of Various Banana Stems (*Musa*) As A Medium for Growing Mustard Plants (*Brassica juncea.)*

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Abstract

Banana stems are parts that have not been utilized optimally, it will be discarded or collected in a place as waste and allowed to rot. The content of banana stems includes potassium, phosphorus and nitrogen which are good for supporting plant growth. Based on these contents, research was carried out using banana stalks as a growing medium for mustard greens (*Brassica juncea)*. The objectives to be achieved in this study were to determine the effect of giving banana stems as a planting medium on the growth of mustard greens. This type of research is experimental, while the experimental design used was a completely randomized design with 3 treatments, namely kepok banana, raja sereh banana and biru banana with 6 repetitions. Data collection techniques by means of observation and measurement. The data that had been collected were analyzed statistically using the analysis of variance test using the SPSS application. From the results of statistical analysis, it shows that giving different kinds of banana stems has no difference in the growth of mustard greens. However, the provision of different types of banana stems can affect the growth of mustard greens where the growth can be increased than the control data because the growth rate of mustard greens is better than the control growth.

Keyword : banana stem, kepok banana, raja sereh banana, biru banana, Brassica juncea growing

1. Introduction

Mustard plants (*Brassica juncea*) belong to the Brassica clan, originating from China (China) and East Asia. It is estimated that the arrival of mustard greens to Indonesia in the XI century coincided with the cross-trade of other sub-tropical vegetables (Rukmana 2007). Mustard greens (*Brassica juncea*) have fiber roots that spread in all directions around the soil surface (Bambang 2003). Has a short and segmented stem as a support for the leaves. The leaves are oval, hairless, smooth, not cropped and have long petioles (Sunarjono 2003; Tiwery 2014). Mustard flowers are arranged in flower stalks that grow elongated and have many branches (Rukmana 2007), (Muhammad & Waluyo 2019). The type of mustard fruit is a pod, elongated and hollow. Each pod contains 2-8 seeds, the seeds are round, blackish brown, and small in size (Bambang 2003; Ali et al. 2017). Mustard (*Brassica juncea*.) Can be cultivated in tropical and subtropical climates as well as in areas with low rainfall. (Telaumbanua et al. 2014; Muhammad & Waluyo 2019). Soil that contains a lot of humus (organic), loose, fertile and has good water disposal is suitable soil for planting mustard greens. (Telaumbanua et al. 2014). The optimum growth rate of acidity (pH) in mustard greens is pH 6 to pH 7 (Ali et al. 2017).

Mustard (*Brassica juncea*) is a vegetable that is often consumed in Indonesia (Telaumbanua et al. 2014; Telaumbanua et al. 2016; Ali et al. 2017; Karnilawati et al. 2018; Muhammad & Waluyo 2019). Mustard plants are also often processed in dishes such as fresh vegetables, side dishes and other food complementary dishes (Bago 2021). Mustard plants contain vitamins A, B, C, E, and K needed by the body, besides that, mustard greens also have chemical components as cancer inhibitors. (Gustia 2013; Kalay et al. 2016; Ali et al. 2017). This mustard plant (*Brassica juncea*) has good prospects for development because of its high nutritional content (Gustia 2013; Telaumbanua et al. 2014; Tiwery 2014). This mustard plant is a vegetable that has high economic value and is in demand by the community, the high need for people to consume vegetables, so the market demand for mustard greens will also increase. (Dhani et al.; Yanti et al. 2014; Muhammad & Waluyo 2019; Wijiyanti et al. 2019). Therefore, the cultivation of mustard greens is needed to increase the production of mustard plants in order to compensate for this increasing demand (Dhani et al.; Wijiyanti et al. 2019). The cultivation of this mustard plant is widely applied by farmers to get fast results because the care of this mustard plant is not that difficult and the plant growth is fast. (Ali et al. 2017). Besides being able to be planted in large rice fields, this mustard plant can also be cultivated on narrow land using pots or polybags. (Ali et al. 2017; Karnilawati et al. 2018). In its maintenance, media and fertilizers are definitely needed that support the growth of mustard greens. Fertilizers that are usually used are chemical fertilizers (Wijiyanti et al. 2019). Continuous use of chemical fertilizers can cause soil hardening (Kalay et al. 2016). Hard soil is caused by residual buildup or chemical fertilizer residue which makes the soil difficult to decompose (Wijaya 2010). The nature of chemicals is relatively more difficult to decompose or disintegrate compared to organic materials. Therefore, organic fertilizers are very safe in the continued growth of vegetables. The hardness of the soil due to chemical fertilizers will make it difficult for the roots to stick to the soil, so it is necessary to modify the planting medium for plant growth..

Planting media is a place for plant growth (Dalimoenthe 2013). The planting medium functions as a place for roots to attach, as well as as a nutrient provider for plants (Agoes 1994) (K. & Suhardjono 2002). A good planting medium is a medium that contains elements needed by plant growth, including water, nutrients, and air cavities (Dalimoenthe 2013; Pratiwi et al. 2017). The mixture of several materials for the planting medium must produce the appropriate structure because each type of media has a different effect on plants (K. & Suhardjono 2002). Planting media can be improved by providing organic materials such as compost, manure or other organic matter (K. & Suhardjono 2002). Planting media that is included in the category of organic matter generally comes from components of living organisms, for example parts of plants such as leaves, stems, flowers, fruit, or bark (Dalimoenthe 2013). Planting media can also be made from banana tree waste, the part of the banana that can be used is banana stems.

Banana stems are part of a banana that has not been utilized optimally, bananas are usually taken only from the fruit, after which they are discarded or collected in a place as waste (Ekariana S. Pandia, Saipul , Rahmani Fitri 2017; Sari et al. 2017; Karnilawati et al. 2018; Sidiq et al. 2020). Banana stems (Musa) have elements that are very important for plant needs, the elements contained include potassium (K), phosphorus (P) and nitrogen (N). (Wulandari et al. 2011; Sari et al. 2017; Murnita & Afrida 2020; Bago

2021). Potassium (K) is able to help the absorption of water and nutrients from the soil, as an enzyme activator and helps transport the assimilation products from leaves to plant tissue (Patti et al. 2013; Firmansyah et al. 2017). Phosphorus (P) is around 0.2-0.5% which can stimulate root growth, increase the percentage of flower formation into fruit, and can stimulate flower formation and fruit / seed ripening (Firmansyah et al. 2017). Nitrogen (N), which can make plants greener, is able to accelerate growth and increase the protein content of crops (Patti et al. 2013). With these elements the banana tree trunk can be used as a medium for growing plants. The abundance of banana stem waste is an idea to use banana stems as a medium for growing vegetables. In this study, banana trees were used as a growing medium for mustard greens (*Brassica juncea*). The purpose of this study was to determine the effect of giving kinds of tiger banana stems on the growth of mustard greens (*Brassica juncea*). The benefits of this research are expected to provide information about the use of banana stems as a planting medium that is environmentally friendly, inexpensive, and easy to make in increasing the growth of mustard greens (*Brassica juncea*).

2. Research Method

2.1Types and research methods

This type of research is an experimental study where the independent variables are various kinds of banana stems as a growing medium while the dependent variable is the growth of mustard greens (*Brassica juncea*). The experimental design used was a completely randomized design (CRD) with 3 treatments, namely kepok banana stalks, raja sereh banana and biru banana with 6 repetitions. The formula used to determine the repetition is t (n-1) ≥ 15 (Wulandari et al. 2011; Marina et al. 2017). As for the repetition as follows, At A = treatment on the trunk of the Kepok banana tree, B = the trunk of the biru banana tree, and C = the trunk of the raja sereh banana tree. In this study, there were 18 experimental units where each experimental unit was planted with 3 mustard seeds.

The data observed in this study included stem height, number of leaves, length and width of leaves and mustard roots. The time and place of the research were carried out in February-April 2021, located in the experimental garden of Kenongosari Village, Soko District, Tuban Regency. Equipment and materials used in this study is a knife / knives, rulers, solatip, stationery, cameras, analytical balance, polybag, mustard seeds, water, soil, organic fertilizer, plantain stalks lemongrass, banana banana kepok blue and yellow. In this experiment, there were 18 experimental units as a result of 3 treatments with 6 repetitions where each experimental unit was planted with 3 mustard seeds (Figure 1). The accuracy of the 18 experimental units of the media was carried out by shaking, as shown in Fig 1 below.

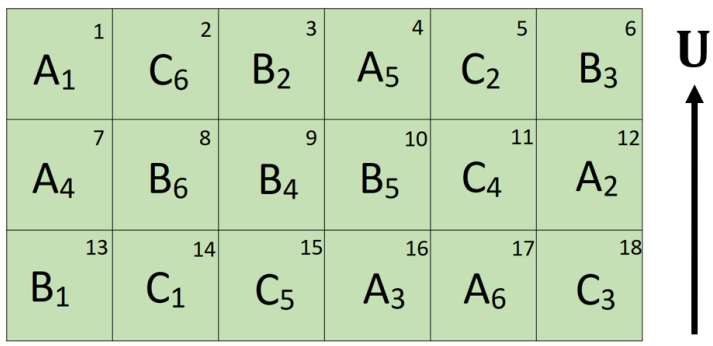
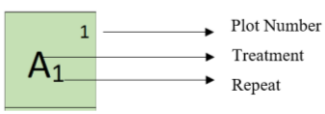


Fig 1. Completely Randomized Design Experiment
Information :



2.2 Research Steps

In this research, the first thing to do is to prepare tools in the form of knives, rulers, solatip, stationery, cameras, analytical scales, polybags, then preparing the materials to be used as research materials, namely mustard seeds, water, soil, organic fertilizers, raja sereh banana stems. , biru banana and kepok banana. Then the next step is to cut the three banana stalks one by one, cut into small pieces measuring ± 1-2 cm, then set aside. The stems that have been cut are then weighed, the slices of yellow kepok banana stems, soil and organic fertilizer using analytical scales with a ratio of 3: 2: 3. Incorporate media that have been mixed in polybag then enter as many mustard seeds 3 seeds. Then repeat these steps on the medium of raja sereh banana and biru banana stalks. The next step is to label each polybag. Then the determination of the 18 units of the media experiment was carried out by shaking, which is presented in Figure 1 above. Flush the media 2 times a day in the morning and evening, if it rains, you don't need to flush it again (Fatimah & Handarto 2008). After that the next step is observation, namely observation of the media. Observations were made once a week by observing leaf length, leaf width, stem height, root length and number of leaves on mustard greens (*Brassica juncea*). Then the observational data that has been collected are grouped and then analyzed.

2.3 Data collection techniques and data analysis

Data collection in this study was carried out by means of observation and measurement. The method of observation and measurement refers to Mas'ud's research steps (Mas'ud 2009). Observations were made by observing leaf length, leaf width, stem height, root length and number of mustard leaves based on each treatment. The data was collected by measuring, namely measuring the length of the leaves, the width of the leaves, the height of the stems, the length of the roots and the number of leaves from each treatment. Leaf length is measured from leaf tip to leaf base. Leaf width is

measured from the distance between leaf edges (Wasis & Sandrasari 2011). The number of leaves is the fully formed leaves counted when the plant starts 3 weeks after planting. Plant height is measured from the base of the stem to the tip of the longest leaf when the plant starts 3 weeks after planting. Then the root length, measured from the base of the root to the longest root at the end of the observation (harvest). After all the data has been collected, they are grouped and analyzed.

In this experimental research, after the data is collected, the data will be analyzed using Analysis of Variance (ANOVA) with the SPSS application. The collected data will be tested for normality first, if the Kolmogorof-Smirnov result is > 0.05 then the data is normally distributed. Then proceed with the homogeneity test in terms of the homogeneity of the Asymp value must be > 0.05, so the variance is homogeneous. The data tested must be normally distributed, then tested for homogeneity and variance. In Variance analysis aims to determine whether there are differences in the growth of the mustard against the influence of variants of banana stem this miscellaneous. If there is influence, it can be continued with the LSD test.

3. Result and Discussion

3.1 Result

Based on the results of the experiment on the use of various kinds of banana stems as a medium for mustard plants, Figure 2 is obtained as follows.

(a) **(b)** **(c)** **(d)**

Figure 2. The growth of mustard plants for each treatment in 3 weeks: a. kepok banana, b. Blue banana, c. Raja sereh banana and d. Control (*Source: Personal Documentation*)

Based on experimental research on the use of various kinds of banana stems as a growing medium for Mustard (*Brassica juncea*) plants, data on stem height, leaf length, leaf width, number of leaves and root length of Mustard (*Brassica juncea*) plants can be generated, which are presented in Fig 3.. Furthermore, the data were analyzed using ANOVA analysis after fulfilling the normality and homogeneity test. ANOVA test results are presented in Table 1 to Table 5.

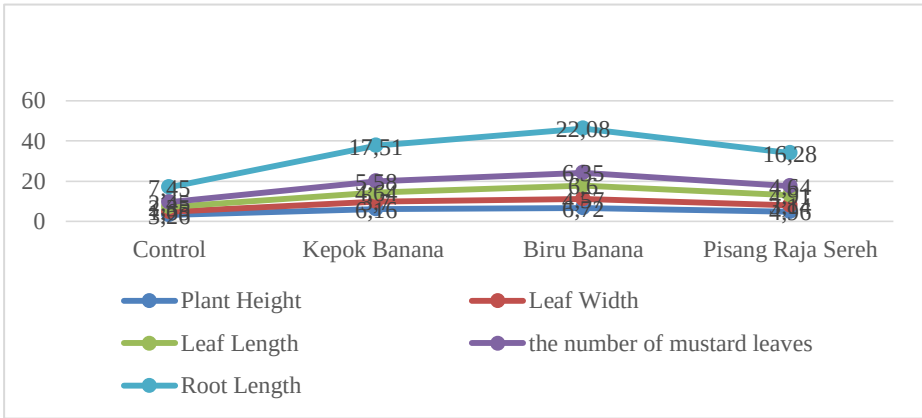


Fig 3. Graph Average Research Results

Table 1. ANOVA Test Results on Plant Height

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.422	5	.484	.368	.861
Within Groups	15.807	12	1.317		
Total	18.228	17			

Source: SPSS 2019

Table 2. ANOVA Test Results on Mustard Leaf Length

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4.907	5	.981	.495	.774
Within Groups	23.779	12	1.982		
Total	28.686	17			

Source: SPSS 2019

Table 3. ANOVA Test Results on Mustard Leaf Width

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.151	5	.430	.541	.742
Within Groups	9.547	12	.796		
Total	11.697	17			

Source: SPSS 2019

Table 4. ANOVA test results on the number of mustard leaves

	Sum of Squares	Df	Mean Square	F	Sig.

Between Groups	7.935	5	1.587	1.389	.296
Within Groups	13.706	12	1.142		
Total	21.641	17			

Source: SPSS 2019

Table 5. ANOVA Test Results on Root Length of Mustard Plants

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	115.046	5	23.009	1.176	.376
Within Groups	234.785	12	19.565		
Total	349.831	17			

Source: SPSS 2019

3.2 Discussion

Based on data analysis on plant height (Table 1.) shows that the results of F_{count} 0.368 <F_{table} 3.11 with Asymp 0.861> 0.05. The average height of the mustard stalks on various kinds of banana stems as a growing medium did not have a difference in the height of mustard greens (*Brassica juncea*). However, giving different kinds of banana stems can affect the growth of mustard plant height where the average can be increased than the data in the control (Graph 1). This shows that the content in banana stems can affect the growth of mustard greens (*Brassica juncea*). The content of banana stems includes potassium (K). This element of potassium has a role in increasing the height of mustard greens (*Brassica juncea*) (Bago 2021). According to Setianingsih et al.(2016) states that "the increase in plant height is influenced by the element K". The element potassium (K) has a role in the vegetative growth of plants, especially in the parts that are actively growing, namely the meristem (shoots) (Setianingsih et al. 2016). If this element is deficient, it shows that it can inhibit the growth of mustard greens (*Brassica juncea*), one of which is that the plant can be stunted (Syafriati et al. 2010). Due to the presence of the K element in banana stems, it affects the height of the mustard greens (*Brassica juncea*). However, it is not only elemental K that affects plant height, but elemental N also has a role to stimulate height growth in plants (Setianingsih et al. 2016; Bago 2021). So the nutrients contained by banana stems are active nutrients that can increase the height of the mustard plant (Bago 2021).

Based on data analysis on leaf length in mustard greens (Table 2), it shows that the results of F_{count} 0.495 <F_{table} 3.11 with Asymp 0.774> 0.05. The average length of mustard leaves in the application of various kinds of banana stems as a growing medium did not have a difference in the leaf length of the mustard plant (*Brassica juncea*). However, giving various kinds of banana stems can affect the growth of mustard leaf length where the average can be increased compared to control data (Graph 1). This shows that the content in banana stems can affect the long growth of leaves of mustard greens (*Brassica juncea*). The content of banana stems, among others, Nitrogen (N). Nitrogen is an important element in growth in entering the vegetative phase (Suryono & Sudadi 2015). In its role this element of nitrogen has a function for the formation of plant organs, plant cells and tissues. Elemental N can play a role in stimulating overall

plant growth, encouraging the formation of leaves and stems of plants (Patti et al. 2013). The presence of nitrogen can help in leaf growth in mustard greens (*Brassica juncea*).

Based on data analysis on leaf width (Table 3), it shows that the results of F_{count} 0.541 <F_{table} 3.11 with Asymp 0.742> 0.05. The average width of the mustard leaves in the various kinds of banana stems as a planting medium did not have a difference in the width of the mustard leaves (*Brassica juncea*). However, giving different kinds of banana stems can affect the growth of mustard leaf width where the average can be increased compared to the control data (Graph 1). This shows that the content present in banana stems can affect the growth of mustard leaf width (*Brassica juncea*). Likewise, the leaf length, element N plays an important role in leaf growth. Elemental N has a role in stimulating overall plant growth, encouraging the formation of plant leaves and stems. Because Element N is a constituent of chlorophyll, protein, the formation of coenzymes and nucleic acids (Setianingsih et al. 2016). So the nutrients contained by banana stems are active nutrients that can increase the growth of mustard plants (Bago 2021).

Based on the analysis of the data on the number of leaves (Table 4.) shows that the results of F_{count} 1.389 <F_{table} 3.11 with Asymp 0.296> 0.05. The average number of mustard leaves in the various kinds of banana stems as a growing medium did not have a difference in the number of leaves of the mustard plant (*Brassica juncea*). However, giving different kinds of banana stems can affect the growth of the number of mustard leaves where the average can be increased compared to the control data (Graph 1). This shows that the content in banana stems can affect the growth of the number of leaves of the mustard plant (*Brassica juncea*). The element N is very important in leaf growth, the leaves will turn yellow if the plant is deficient in this nitrogen element, it will cause disturbances in its development, for example an imperfection of plant metabolism which can result in symptoms of nutrient deficiency (Purwati 2017). In addition, N also has a role as a building block for proteins, the formation of chlorophyll coenzymes, and nucleic acids (Setianingsih et al. 2016; Bago 2021). The K element also plays a role in leaf formation because the K function can strengthen and strengthen the plant body, and is able to stimulate leaf growth (Bago 2021). Various other nutrients can also affect the number of leaves of the mustard plant (*Brassica juncea*). (Karnilawati et al. 2018). Banana stems contain nutrients that can fertilize the soil so that the plant can produce more leaves (Karnilawati et al. 2018; Bago 2021).

Based on data analysis about root length (Table 5.) shows that the results of F_{count} 1.176 <F_{table} 3.11 with Asymp 0.376> 0.05. The average length of mustard roots in the application of various kinds of banana stems as a growing medium did not have a difference in the root length of mustard greens (*Brassica juncea*). However, the provision of different types of banana stems can affect the growth of mustard roots in which the average can be increased compared to the control data shown in Graph 1. This shows that the content in banana stems can affect the length growth of mustard greens (*Brassica juncea*). One of the ingredients of banana stems is the element phosphorus (P). According to Rosita et al, (2020) "The function of the element P is very important because it is a source of energy in every plant metabolic process." The element P also has a role in root development, fruit seeds and flowers. Phosphorus (P) is around 0.2-0.5% which can stimulate root growth, increase the percentage of flower formation into fruit, and can stimulate flower formation and fruit / seed ripening

(Firmansyah et al. 2017). In addition, there is an element of N nitrogen which acts as a root formation (Purwati 2017). Both have an important role in plant growth.

3.3 Conclusion

From the results of statistical analysis, it shows that giving different kinds of banana stems has no difference in the growth of mustard greens. However, giving various kinds of banana stems can affect the growth of mustard plants where the growth can be increased than the control data. This means that the addition of banana stems to the growing media has an effect on the growth of mustard plants because the growth rate of mustard greens is better than the growth rate of the control, but for the type of distribution there is nothing different or better than the three treatments.

References

Agoes D. 1994. Berbagai Jenis Media Tanam dan Penggunaannya. Penebar Swadaya Jakarta.

Ali M, Koyoga W, Pratiwi YI. 2017. Teknik Budidaya Tanaman Sawi Hijau (Brassica juncea L). :1–9.

Bago AS. 2021. Pengaruh Media Tanam Gedebog Pisang Terhadap Pertumbuhan Tanaman Sawi Pahit (Brassica juncea. L). 9(1):508–515.

Bambang C. 2003. Teknik dan Strategi Budi Daya Sawi Hijau (pai-sai). Yayasan Pustaka Nusantara, Yogyakarta.:12–62.

Dalimoenthe SL. 2013. Pengaruh Media Tanam Organik Terhadap Pertumbuhan Dan Perakaran Pada Fase Awal Benih Teh Di Pembibitan. :1–12.

Dhani H, Wardati, Rosmimi. Pengaruh Pupuk Vermkompos Pada Tanah Inceptisol Terhadap Pertumbuhan Dan Hasil Sawi Hijau (Brassica juncea L).

Ekariana S. Pandia, Saipul , Rahmani Fitri SS. 2017. Pemenfaatan Limbah Batang Pisang Sebagai Media Tanam Di Desa Peunaron Lama Kecamatan Peunaron Kabupaten Aceh Timur. 4(1):30–35.

Fatimah S, Handarto BM. 2008. Pengaruh Komposisi Media Tanam Terhadap Pertumbuhan Dan Hasil Tanaman Sambiloto (Andrographis Paniculata, Nees). 5(2):133–148.

Firmansyah I, Syakir M, Lukman L. 2017. Pengaruh Kombinasi Dosis Pupuk N , P , dan K Terhadap Pertumbuhan dan Hasil Tanaman Terung (Solanum melongena L .) [The Influence of Dose Combination Fertilizer N , P , and K. (Sumiati 1989):69–78.

Gustia H. 2013. Pengaruh Penambahan Sekam Bakar Pada Media Tanam Terhadap Pertumbuhan Dan Produksi Tanaman Sawi (Brassica juncea L.). 1.

K. NA, Suhardjono H. 2002. Peranan Berbagai Komposisi Media Tanam Organik Terhadap Tanaman Sawi (Brassica juncea L .) Di Polybag. :54–58.

Kalay AM, Hindresah R, Talahaturuson A, Langoi AF. 2016. Efek Pemberian Pupuk Hayati Konsordium Terhadap Pertumbuhan dan Hasil Tanmanan Sawi (Brassic juncea L.). 8(2):131–138.

Karnilawati, Mawardiana, Asmayani N. 2018. Pemanfaatan Batang Pisang Semu Sebagai Pot Dan Media Tanam Terhadap Pertumbuhan Dan Hasil Tanaman Sawi (Brassica juncea L.). :649–654.

Marina E, Fitriani L, Krisnawati Y. 2017. Pengaruh Pupuk Organik Cair (POC) Batang Pisang (Musa paradisiaca L.) Terhadap Pertumbuhan Tanaman Sawi Pahit (Brassica juncea L.). :1–14.

Mas'ud H. 2009. Sistem Hidroponik Dengan Nutrisi Dan Media Tanam Berbeda Terhadap Pertumbuhan Dan Hasil Selada. 2(2):131–136.

Muhammad RF, Waluyo B. 2019. Variabilitas Genetik dan Heritabilitas Karakter Agronomi Galur- Galur Sawi (Brassica juncea L.). 3(2):73–83.

Murnita, Afrida. 2020. Pemanfaatan Batang Pisang Untuk Pembuatan Pupuk Organik Cair. 01(1):148–153.

Patti PS, Kaya E, Silahooy C. 2013. Analisis Status Nitrogen Tanah Dalam Kaitannya Dengan Serapan N Oleh Tanaman Padi Sawah Di Desa Waimital, Kecamatan Kairatu, Kabupaten Seram Bagian

Barat. 2(1):51–58.
Pratiwi NE, Simanjuntak BH, Banjarnahor D. 2017. Pengaruh Campuran Media Tanam Terhadap Pertumbuhan Tanaman Stroberi (Fragaria vesca L.) Sebagai Tanaman Hias Taman Vertikal. :11–20.
Purwati AD. 2017. Uji Kandungan N dan P Pupuk Organik Cair Kombinasi Batang Pisang dan Sabut Kelapa dengan Penambahan Kotoran Ayam Sebagai Bioaktivator. 11(1):92–105.
Rukmana R. 2007. Bertanam Petsai dan Sawi. Kanisius, Yogakarta.:11–35.
Sari PK, Lekat A, Fajri M. 2017. Pemanfaatan Batang Semu Pisang Sebagai Media Tumbuh Dengan Berbagai Sumber Unsur Hara Terhadap Pertumbuhan Pre Nursery Kelapa Sawit (Elaesis guinensis Jacg). 1(1):37–47.
Setianingsih E, Herlina N, Setyobudi L. 2016. Pemanfaatan Batang Semu Pisang sebagai Pot dengan Berbagai Komposisi Media Tanam terhadap Produktivitas Tanaman Kangkung Darat (Ipomoea reptans L.). J Produksi Tanam. 4(2):117–122.
Sidiq AW, Niati A, Rizkiana C. 2020. Pemberdayaan Ibu Rumah Tangga Dalam Upaya Peningkatan Kesejahteraan Keluarga Dengan Memanfaatkan Limbah Pohon Pisang. Surya Masy. 2(2):110–114.
SMD R, Raharjo M, Kosasih. 2020. Pola Pertumbuhan Dan Serapan Hara N, P, K Tanaman Bangle (Zingiber purpureum Roxb.). J Penelit Tanam Ind. 11(1):32.
Sunarjono HH. 2003. Bertanam 30 Jenis sayur. Penebar Swadaya, jakarta.:78–82.
Suryono S, Sudadi S. 2015. Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. Agrosains J Penelit Agron. 17(2):49.
Syafriati YM, Ernaningsih D, Galis R, Kago W. 2010. Pengaruh Pupuk Organik Kotoran Sapi dengan Takaran yang Berbeda Terhadap Pertumbuhan Sawi (Brassica juncea L). :1–9.
Telaumbanua M, Purwantana B, Sutiarso L. 2014. Rancangbangun aktuator pengendali iklim mikro di dalam Greenhous Untuk Pertumbuhan Tanaman Sawi (Brassica rapa var.parachinensis L.). 34(2):213–222.
Telaumbanua M, Purwantana B, Sutiarso L, Falah MAF. 2016. Studi Pola Pertumbuhan Tanaman Sawi (Brassica rapa var. parachinensis L.) Hidroponik Di Dalam Greenhouse Terkontrol. 36(1).
Tiwery RR. 2014. Pengaruh Penggunaan Air Kelapa (Cocos nucifera) Terhadap Pertumbuhan Tanaman Sawi (Brassica juncea L .). 1:86–94.
Wasis B, Sandrasari A. 2011. Pengaruh Pemberian Pupuk Kompos terhadap Pertumbuhan Semai Mahoni (Swietenia macrophylla King .) pada Media Tanah Bekas Tambang Emas (Tailing) Influence of Compost on the Growth of Seedling of Mahogany. 03(01).
Wijaya K. 2010. Pengaruh Konsentrasi Dan Frekuensi Pemberian Pupuk Organik Cair Hasil Perombakan Anaerob Limbah Makanan Terhadap Pertumbuhan Tanaman Sawi (Brassica juncea L.). :1–55.
Wijiyanti P, Hastuti ED, Haryanti S, Biologi PS, Biologi D, Diponegoro U. 2019. Buletin Anatomi dan Fisiologi Volume 4 Nomor 1 Februari 2019 Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras Terhadap Pertumbuhan Tanaman Sawi Hijau (Brassica juncea L .). 4.
Wulandari AS, Mansur I, Surgiarti H. 2011. Pengaruh Pemberian Kompos Batang Pisang terhadap Pertumbuhan Semai Jabon (Anthocephalus cadamba Miq .). Silvikultur Trop.(01):78–81.
Yanti SEF, Masrul E, Hannum H. 2014. Pengaruh Berbagai Dosis Dan Cara Aplikasi Pupuk Urea Terhadap Produksi Tanaman Sawi (Brassica juncea L .) Pada Tanah Inceptisol Marelan. 2(2337):770–780.