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The Effect of Composted Oil Palm Empty Bunches on Growth and Yield of Pak Choy Plants in Ultisol Soil

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ABSTRACT

Ultisols has many resistor to being used as agricultural land, including problems with soil acidity, low organic matter, low macro nutrients, low cation exchange capacity. Empty Fruit Bunch (EFB) compost has a high content of organic N, K and C and can be used as an alternative fertilizer for ultisol for cultivating plants such as Pak Choy. This research aims to ascertain the effect of giving EFB compost on the growth and yield of Pak Choy plants in ultisols and to find out the best dose. The research used a completely randomized design (CRD) with one factor consisting of 5 treatments with 4 replications so that there were 20 experimental units, the treatments consisted of t0 = EFB 0 ton.ha-1, t1 = EFB 15 ton.ha-1, t2 = EFB 20 ton.ha-1, t3 = EFB 25 ton.ha-1, t4 = EFB 30 ton.ha-1. The research implementation started with weighing 5 kg of soil then putt in a polybag, increase EFB treatment according to the treatment, then incubating for 2 weeks. During incubation, Pak Choy seeds are planted until they are 14 days and transplanted by inserting one plant per polybag. During cultivation, maintenance is carried out including watering in the morning and evening, weeding, dumping, pest control, and observing plant growth and yield. The observation parameters were plant height, number of leaves, fresh weight, and root length. The research results showed that the application of EFB compost had a significant effect on the growth and yield of Pak Choy plant on ultisols and the best dose was the treatment of 25 ton.ha-1 EFB.

Keywords: Ultisol, EFB, Pak Choy.

1. Introduction

Ultisol, one of the soil groups covering approximately 25% of Indonesia's total land area, is widely distributed, encompassing an area of 45,794,000 hectares. The island of Kalimantan has the broadest distribution, reaching 21,938,000 hectares (Prasetyo & Suriadikata, 2006). Despite its significant potential for agriculture, Ultisol faces several obstacles that need to be overcome before it can be utilized for cultivation. Common issues encountered with Ultisol involve high acidity levels, with an average pH below 4.50, high aluminum saturation, and deficiencies in macro nutrients such as P, K, Ca, and Mg. Low organic matter content is also a serious constraint. Additionally, the low organic matter content of the soil is often associated with a decline in soil physical properties, such as compacted or loose soil structure, low water retention capacity, low water infiltration rate, and high soil erodibility (Widowati, 2009).

Ultisol can be found in various topographies, ranging from flatlands to mountains. The characteristic feature of Ultisol is the accumulation of clay in the subsurface layer, reducing the soil's ability to absorb water, increasing surface runoff, and elevating the risk of soil erosion (Prasetyo & Suriadikata, 2006). Kalimantan has a wet tropical climate, generally warm and humid. The high rainfall keeps the soil consistently wet, and easily soluble materials often undergo movement (leaching)

(MacKinnon et al., 1996). The leaching process causes bases present in the soil to be pushed out of the soil environment, and those remaining in the soil react to form acidic compounds due to the low base saturation level (Andalusia *et al*., 2016).

Empty palm fruit bunches are the organic residual material from the palm oil production process that still holds beneficial value for soil and plants. The amount of empty fruit bunches generated reaches 23% of the total fresh fruit bunches, so each processing of 1 ton of fresh fruit bunches will produce about 230 kg of empty fruit bunches (Darnoko, 2005). Empty fruit bunches can be utilized by transforming them into compost, which can then be used as organic fertilizer to support plant growth. Compost generally refers to the process of decomposing organic matter or breaking down complex compounds into simpler compounds with the assistance of microorganisms. Empty fruit bunches have a significant potassium content and, without requiring the addition of starter or additional chemicals, can enhance the physical, chemical, and biological properties of the soil, making it more nutrient-rich. (Widiastuti & Panji, 2007).

After being analyzed at the Central Palm Oil Research Laboratory, it was revealed that the nutrient content in PKC compost is relatively high, particularly the potassium (K) content, reaching 127.9 mg/100g (Darmosarkoro & Rahutomo, 2003). Sarwono (2008) stated that the addition of compost from empty palm fruit bunches can reduce the use of inorganic fertilizers by up to 60%. Findings from Amri's research (2018) indicate that the combination of compost from empty palm fruit bunches and dolomite has a positive impact on the vegetative growth and root development of oil palm seedlings in the main nursery. Lahirsin et al. (2017) explain that a mixture of compost from empty palm fruit bunches, totaling 450 g, with 2 g of urea, results in optimal growth of oil palm seedlings in the pre-nursery

Pak Choy, belonging to the Brassicaceae family, is a type of vegetable rich in vitamins and minerals, providing significant health benefits and disease prevention. Pak Choy plants have high economic value, requiring efforts to increase their production (Wahyuningsih et al., 2017). Pak Choy, a popular variety of Chinese cabbage in current farming practices, has broader stems and leaves compared to regular green cabbage, making it more commonly used in various recipes by the community. Pak Choy has better temperature tolerance than white cabbage, so its cultivation in highland and lowland areas does not differ significantly due to its high adaptability. This opens up bright business opportunities for farmers because its cultivation is relatively easy, and there is sufficient market demand. The stages of Pak Choy cultivation include seed procurement, land preparation, planting process, procurement of fertilizers and pesticides, as well as plant care processes (Sukmawati, 2012).

2. Materials and Methods

Materials

This research utilized various materials, including water, Pak Choy seeds, dolomite, EFB/TKKS compost, chicken manure fertilizer, urea fertilizer, and Ultisol soil. The tools employed in this study included writing tools, trays, hoes, buckets, augers, cameras, research labels, rulers, polybags, tarps, and scales.

This research employed a Completely Randomized Design (CRD) with one factor. The treatments in this study involved the application of PKC compost, consisting of 5 levels:

t_0 = EFB/TKKS (0 ton ha^{-1}) (0g/polybag)
t_1 = EFB/TKKS (15 ton ha^{-1}) (38g/polybag)
t_2 = EFB/TKKS (20 ton ha^{-1}) (50g/polybag)
t_3 = EFB/TKKS (25 ton ha^{-1}) (63g/polybag)
t_4 = EFB/TKKS (30 ton ha^{-1}) (75g/polybag)

This study was conducted using polybags, each containing 20 plant units resulting from the 5 treatment levels with 4 replications.

Methods

Preparation of planting media

The planting media that needs to be prepared is a polybag measuring 35 x 35 cm, 150 kg of ultisols, 2 kg of empty fruit bunch compost, 1 kg of chicken manure and 400 g of dolomite.

Sampling of ultisols and EFB

Ultisols was obtained from the Gunung Kupang Cempaka area. In the sampling process, 150 kg of soil was taken at a depth of 0-20 cm from the ground surface. Soil was collected using a hoe, then put into sacks and taken to the research location. Next, the soil is spread and cleaned of plant roots and rocks. Meanwhile, EFB which has been naturally decomposed for 8 years was taken from PT. Hasnur Citra Terpadu. The process of collecting EFB is done manually by placing it in prepared sacks.

Application of EFB Treatment and Chicken Manure

A total of 5 kg of ultisols was mixed with EFB according to the treatment dose, chicken manure at a dose of 10 tons ha-1 (25 g/polybag), and dolomite at a dose of 4 tons ha-1 (10 g/polybag). The mixture is put into a bucket, stirred until evenly distributed, and then put into a polybag. Next, the polybag was label treatment, and the soil was incubated for 2 weeks.

Seeding and Transplanting

Pak Choy seeds of the Nauli variety are sown using husks as a growing media in tubs. The process of planting seeds is carried out in the nursery for 14 days, and the leaves grow around 4 leaf blade. Sowing of seeds is carried out simultaneously with soil incubation, so that the time for transplanting corresponds to the completion of the incubation process. Transplanting to soil media is done by planting one pakchoi plant seed per polybag. At the time of transplanting, additional fertilization is carried out for the pakchoi plants using urea fertilizer at a dose of 100 kg. ha-1 (0.25 g/polybag). This urea fertilizer is given by immersing it in the soil, surrounding the Pak Choy plant.

Maintenance

Maintenance carried out involves watering twice a day in the morning and evening. Embroidery is carried out as quickly as possible, carried out at 7 HST by replacing plants that do not grow normally or die. Weeding is done by pulling the weeds directly using your hands. Control of plant pests, such as caterpillars, is done manually by catching them with your hands.

Observation

Observations of the height of the pakchoi plant were carried out weekly until the plants reached 4 weeks of age. The first observation was made when the plants were 1 wp old, and the age of the plants was calculated from after transplanting. The observation method involves measuring the height of the Pak Choy plant using a ruler, starting from the base of the stem to the tip of the longest leaf which is held upwards. Observations of the number of leaves on Pak Choy plants were also carried out weekly until the plants reached the age of 4 after the month. The first observation was made when the plants were 1 wp old, with the criteria for leaves being counted being leaves that had fully bloomed. Observation of the fresh weight of Pak Choy plants is carried out after harvesting, namely Pak Choy plant that have been removed, cleaned of soil that is still attached, separated from the roots, and then weighed on a digital scale. Observation of the root length of Pak Choy plants was also carried out after harvesting. Pak Choy plants that have been removed are cleaned of soil attached to the roots, and the length of the root is measured from where the root grow to the tip of the longest root. Pak Choy harvest is carried out using the uprooting method after the plants reach the age of 4 WAP or 28 days after being transferred to the Ultisols growing medium.

Data Analysis

The research data obtained was input and tabulated into Excel and then analyzed for homogeneity using barlet variations. After the homogeneous data was further tested using ANOVA at a 5% error level to see the effect of treatment, then treatment differences were tested using the 5% LSD test. Data analysis was carried out using the SPSS Ver. analysis tool. 20.

3. Results and Discussion

Content of Ultisols and EFB Compost

The initial soil in this study was analyzed for the content of several chemical elements. The results of the initial soil chemical content analysis are as follows.

Table 1. Chemical content of ultisols

N-total	C-org	P_2O_5	K_2O	pH (H_2O)	Al	CEC	Al Saturation
-------%------		mg/100g		-	-- cmol(+)kg^{-1} --		%
0,22 M	2,51 M	28,87 M	2,44 VL	5,2 S	1,2 VL	19,28 M	6,22 L

Description : M: Medium, S: Sour, L: Low, VL: Very Low
Source : Lab. Land, Faculty of Agriculture, Lambung Mangkurat University, 2022

The table above shows that the soil pH is classified as acidic, namely 5.2. N Total is Medium 0.22%, C-organic is Medium 2.51%, P2O5 is Medium 28.87%, K2O is Very Low 2.44 mg/100 g, available Al is Very Low 1.2 cmol/kg, CEC is Medium 19 .28 cmol/kg, and Low Al saturation of 6.22%. According to Fitriatin (2014) ultisol is a soil that has problems with soil acidity, low organic matter and low macro nutrients and has very low P availability. Soil pH is related to exchangeable aluminum content and aluminum saturation, that as the soil pH value increases, the Al-dd value and aluminum saturation in the soil will decrease. Likewise, with decreasing soil pH, the Al-dd value in the soil will increase. This is in line with the results of the soil analysis in Table 1 which shows that the soil pH which is classified as acid corresponds to low Al saturation and very low Al-dd, thus the soil used in the research can be used for cultivation by making improvements to increase the soil pH so that according to what the Pak Choy plant wants, namely 5.5-6. The K-dd value is classified as very low, because the ultisols according to Adiwiganda et al (1996) said that Typic Ochraquults comes from clay rock parent material which has a low K content, and it is necessary to add organic or inorganic materials containing high K for plant growth. optimal.

Table 2. Chemical content of EFB compost

Compost content	Value	Compost SNI criteria		
		Min	Maks	Information
N (%)	3,09	0,40	*	M
P (%)	Tb	0.10	-	DM
K (%)	0,73	0,20	*	M
C-organik (%)	46,47	27	58	M
pH H_2O (%)	4,86	6,80	7,49	DM
Mg (%)	0,21	*	0.60	M

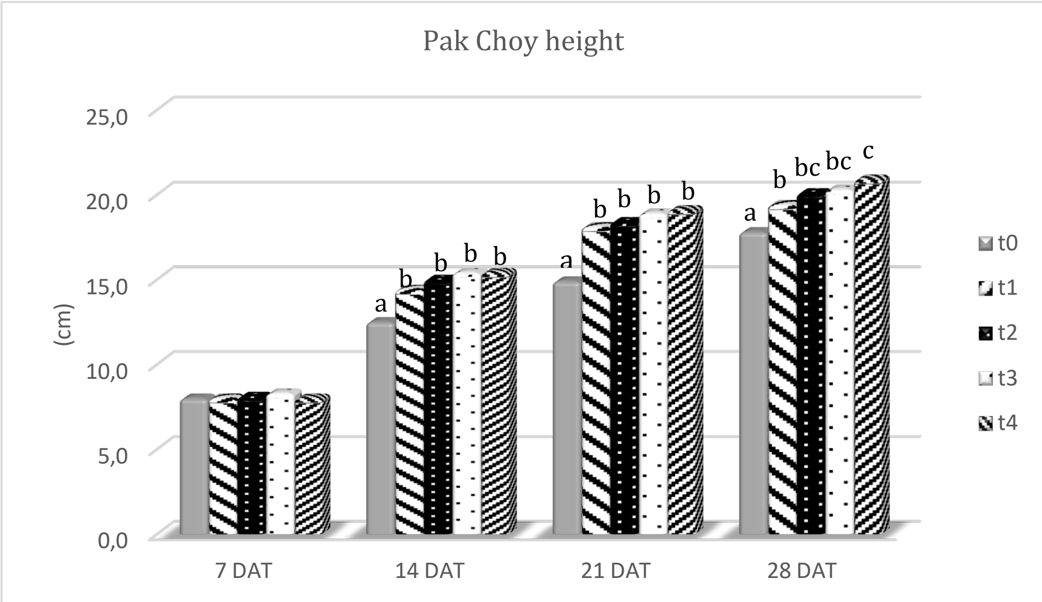
Information : M : Meets, DM : Doesn't Meets
Tb : not readable by the measuring instrument used.
Source : Lab. Land of Banjarbaru Agricultural Research and Development Agency, South Kalimantan, 2022.

Carbon is an important building block of organic matter, because most (58%) of plant dry matter consists of organic matter (BO). Organic carbon (C-organic) in BO has long been known as a characteristic of soil fertility and productive land. Half of the amount of carbon absorbed by plants enters the soil through plant remains (litter), dead plant roots and other soil organisms which will experience decomposition so that they accumulate in the soil layer (Ruddiman, 2007). In the soil ecosystem, organic C is an important component that influences soil properties to support plant growth, namely as a source of energy for soil organisms and triggers nutrient availability for plants. According to Collins et al., (1992), one indicator of the success of agricultural land management is maintaining soil organic C reserves, so that the balance in the soil, environment and biodiversity is maintained and sustainable. Based on Table 2, the carbon in EFB is classified as high, so it is very supportive for plant growth in ultisols which has a lower C-Organic content compared to EFB (Table 1). The nutrient N is an essential macro nutrient, making up around 1.5% of plant weight and functions mainly in protein formation (Hanafiah, 2005). The benefits of nitrogen are to stimulate plant growth in the vegetative phase, and play a role in the formation of chlorophyll, amino acids, fats, enzymes and other compounds (Susanto, 2005). Soil nitrogen levels are usually a basic indicator for determining urea fertilizer doses.

Plant Height

The analysis of variance (ANOVA) results showed that the application of oil palm EFB compost had no significant effect on the plant height parameter of Pak Choy at 7 days after transplanting (DAT). However, it had a highly significant impact at 14 DAT, 21 DAT, and 28 DAT. The influence of the application of oil palm EFB compost on the plant height of Pak Choy is illustrated in picture 1.

Picture 1. Observation result of Pakcoy height



Description = t0 : EFB/TKKS 0 ton ha^{-1}, t1 : EFB/TKKS 15 ton ha^{-1}, t2 : EFB/TKKS 20 ton ha^{-1} t3 : EFB/TKKS 25 ton ha^{-1}, t4 : EFB/TKKS 30 ton ha^{-1}

Referring to the data, the treatments that had a significant effect were then followed by a post hoc test using the Duncan Multiple Range Test (DMRT) at a 5% significance level. Consequently, it can be observed that at 14 days after transplanting (DAT) and 21 DAT, treatment t0 significantly differed from all other treatments, while treatments t1, t2, t3, and t4 did not significantly differ from each other. At 28 DAT, treatment t0 significantly differed from all other treatments, and treatment t1 did not significantly differ from t2 and t3 but significantly differed from t4.

The application of empty palm fruit bunch (EFB) compost did not have a significant effect on the plant height parameter of Pak Choy at 7 days after transplanting (DAT). This situation may be attributed to the underdevelopment of the root system, specifically the limited number of roots. Consequently, the root's ability to absorb nutrients and minerals from the soil may not have reached its maximum level during that period (Irawati, 2017). Additionally, EFB compost is a type of organic fertilizer with slow availability for plants. Nutrients in this fertilizer become available gradually, working in stages. This process requires breakdown by soil organisms to release nutrients, and this takes time (Pardosi, 2014).

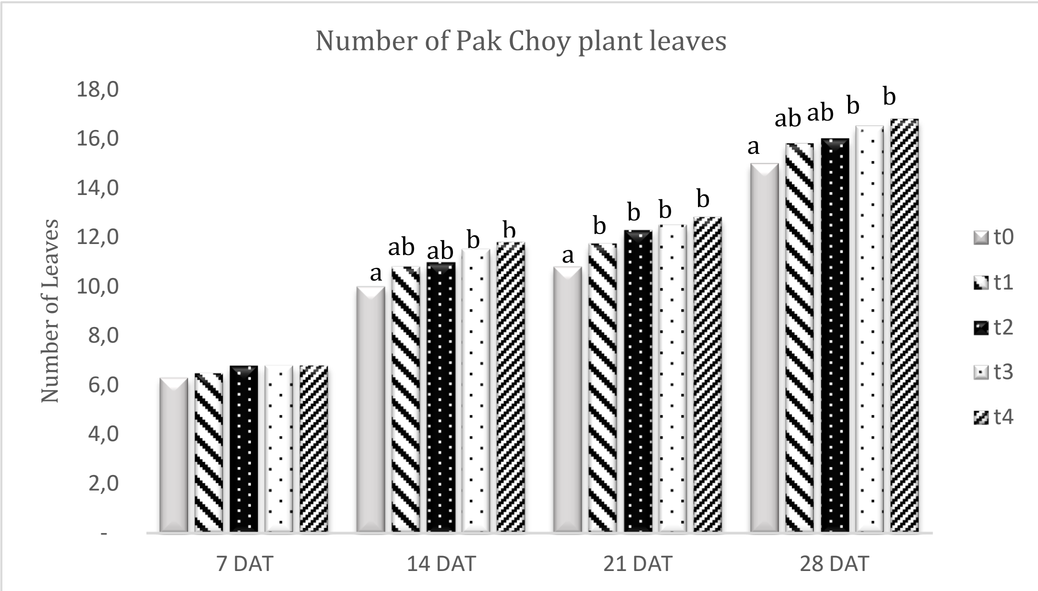
The plant height at 14 days after transplanting (DAT), 21 DAT, and 28 DAT had a highly significant effect. The data indicates that the roots have experienced growth, and their quantity has increased compared to the 7 days after transplanting (DAT). This allows the plant to absorb nutrients more efficiently, accelerating its growth. Additionally, the nutrients from the compost fertilizer are available, contributing to the increase in plant height. The heightened plant growth is due to the ability of Pak Choy plants to absorb nitrogen (N) and potassium (K) present in the empty palm fruit bunch compost. Wahyudi (2010) stated that the availability of nitrogen plays a key role in supporting plant growth during the vegetative phase, thus contributing to the increase in plant height. The increase in plant height is also influenced by the presence of phosphorus (P), which plays a crucial role in several metabolic processes to support optimal plant growth. Moreover, potassium (K) acts as an enzyme activator in the photosynthesis process, also playing a role in the increased plant height (Hakim *et al.*,1986).

The addition of EFB compost to Ultisol soil in treatment t4 was able to increase plant height. This is due to the ability of PKC compost to provide the necessary nutrients, thus optimizing the growth of Pak Choy plants. Treatment t4 with a dose of 30 tons ha^{-1} was identified as the best treatment because it produced plants with the most optimal height, reaching an average plant height value of 20.9 cm.

Number of Pak Choy plant leaves

The analysis of variance (ANOVA) results showed that the application of oil palm EFB compost had no significant effect on the number of Pak Choy plant leaves parameter at 7 days after transplanting (DAT). However, it had a significant impact at 14 DAT, a highly significant impact at 21 DAT, and significant impact 28 DAT. The influence of the application of oil palm EFB compost on the Number of Pak Choy plant leaves is illustrated in picture 2.

Picture 2. Observation result of the number of Pak Choy plant leaves



Description = t0 : EFB/TKKS 0 ton ha^{-1}, t1 : EFB/TKKS 15 ton ha^{-1}, t2 : EFB/TKKS 20 ton ha^{-1} t3 : EFB/TKKS 25 ton ha^{-1}, t4 : EFB/TKKS 30 ton ha^{-1}

Referring to the data, the treatments that had a significant effect were then subjected to a post hoc test using the Duncan Multiple Range Test (DMRT) at a 5% significance level. Consequently, it can be observed that at 14 days after transplanting (DAT), treatment t0 did not significantly differ from treatments t1 and t2 but significantly differed from treatments t3 and t4. Treatment t4 did not significantly differ from treatment t3. At 21 DAT, treatment t0 significantly differed from all other treatments, while treatments t1, t2, t3, and t4 did not significantly differ from each other. At 28 DAT, treatment t0 did not significantly differ from treatments t1 and t2 but significantly differed from treatments t3 and t4. Treatment t4 did not significantly differ from treatment t3

The application of oil palm EFB compost did not have a significant effect on the parameter of the number of Pak Choy plant leaves at 7 days after transplanting (DAT). The lack of influence is closely related to the nature of compost fertilizer, which is slow-release, where its nutrients are obtained gradually and require time. This factor is reinforced by the condition of the immature root system of young plants, so their ability to absorb nutrients has not reached its maximum level, resulting in relatively slow leaf growth.

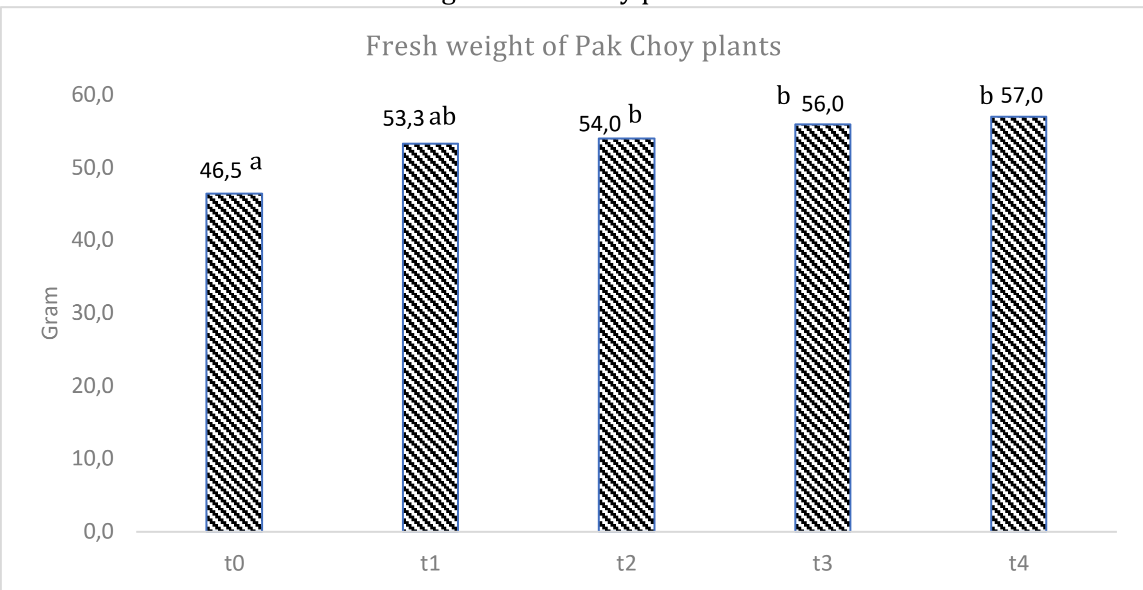
The number of Pak Choy plant leaves at 14 days after transplanting (DAT) and 28 DAT had a significant effect, and a highly significant effect at 21 DAT. Based on the examination of nutrient content in Ultisol soil and PKC used in this study, it can be noted that Ultisol soil has a total N content of 0.22% (moderate category) and P content of 28.87 mg/100g (moderate category). Meanwhile, PKC has an N content of 3.09%, which meets the criteria of the Indonesian National Standard (SNI) for N content in compost. Lakitan (1996) stated that the nutrient with the most significant impact on leaf growth and development is nitrogen. Nitrogen plays a role in cell and chlorophyll formation, which is essential in the photosynthesis process to produce the energy needed for cell division, expansion, and elongation. Phosphorus (P) plays a crucial role in accelerating plant development, serving as a crucial component in the formation of compounds for energy transfer (ADP - ATP) and stimulating leaf growth in plants (Novizan, 2002).

Treatment t3 with a dose of 25 tons ha^{-1} of EFB was identified as the treatment with the best dose because it produced plants with a number of leaves that did not significantly differ from plants that received a EFB dose of 30 tons ha^{-1} (t4). Focusing on economic efficiency, treatment t3 shows that with a smaller amount of compost, it is still able to produce a number of leaves that do not significantly differ from the higher dose. The average number of leaves in treatment t3 reached 16.5 leaves per plant

Fresh weight

The analysis of variance (ANOVA) results showed that the application of oil palm EFB compost had a significant effect on the fresh weight of Pak Choy plant. The influence of the application of oil palm EFB compost on the fresh weight of Pak Choy plant is illustrated in picture 3.

Picture 3. Observation result of fresh weight of Pak Choy plants.



Description = t0 : EFB/TKKS 0 ton ha^{-1}, t1 : EFB/TKKS 15 ton ha^{-1}, t2 : EFB/TKKS 20 ton ha^{-1}
t3 : EFB/TKKS 25 ton ha^{-1}, t4 : EFB/TKKS 30 ton ha^{-1}

Referring to the data, the treatments that had a significant effect were then subjected to a post hoc test using the Duncan Multiple Range Test (DMRT) at a 5% significance level. Consequently, it can be observed that for the parameter of plant fresh weight, treatment t0 did not significantly differ from treatment t1 but significantly differed from treatments t2, t3, and t4. Treatment t4 did not significantly differ from treatments t2 and t3.

The determination of fresh weight was conducted by measuring the weight of the plants before experiencing moisture loss. The higher the parameters of plant height, the number of leaves, and root development, the greater the value of the fresh weight of the plants (Lakitan, 2012). This statement is confirmed by the results of the research I have conducted. Treatment t0 showed the lowest average height, which is 17.8 cm, with the lowest average number of leaves at 15 leaves per plant, and the shortest average root length of about 13.5 cm. This resulted in plants in t0 having the lowest average fresh weight, approximately 46.5 g per plant. Meanwhile, for treatment t4, there was the best average height of 20.9 cm, the highest average number of leaves at 16.8 leaves per plant, and the longest average root length reaching 14.8 cm. As a result, plants in treatment t4 exhibited the highest average fresh weight, approximately 57 g per plant

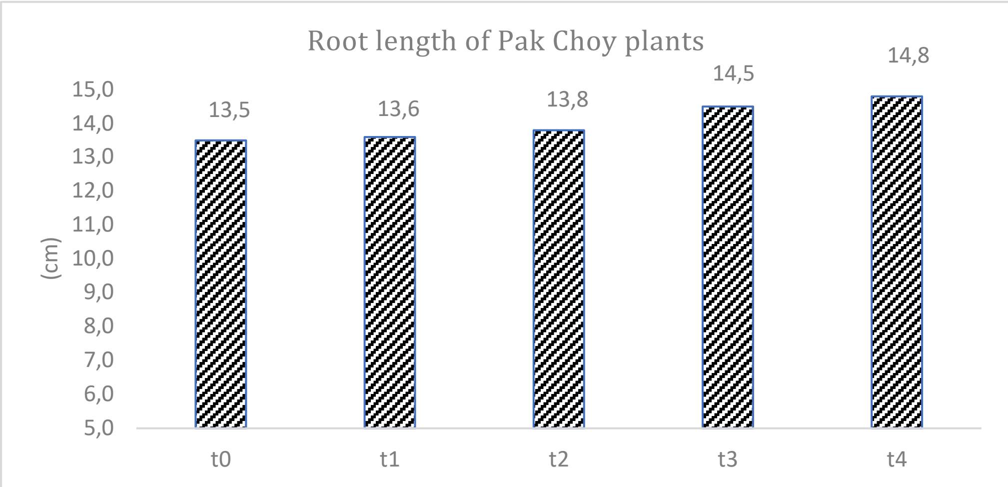
Based on the results of this research, it can be concluded that the fresh weight of Pak Choy plants in all treatments increases with the increasing dose of EFB. In this study, treatment t4 (EFB 30 tons ha^{-1}) showed the highest fresh weight with an average of 57.0 g per plant, while treatment t0 (EFB 0 tons ha^{-1}) had the lowest fresh weight, approximately 46.5 g per plant. These findings affirm that the application of EFB effectively enhances the availability of nutrients in the soil for plant absorption, thereby providing support for its growth.

The treatment with a dose of 20 tons ha^{-1} (t2) is identified as the treatment with the best dose because it provides an impact that is not significantly different from the treatments with doses of 25 tons ha^{-1} (t3) and 30 tons ha^{-1} (t4). Focusing on economic efficiency, treatment t2 shows that with a smaller amount of compost, it can still produce a fresh weight of plants that is not significantly different from the higher doses. The average fresh weight value in treatment t2 reaches 54.0 g/plant.

Root length

The analysis of variance (ANOVA) results showed that the application of oil palm EFB compost had no significant effect on the root length of Pak Choy plant. The influence of the application of oil palm EFB compost on the root length of Pak Choy plant is illustrated in picture 4.

Picture 4. Observation result of root length of Pak Choy plants.



Description = t0 : EFB/TKKS 0 ton ha^{-1}, t1 : EFB/TKKS 15 ton ha^{-1}, t2 : EFB/TKKS 20 ton ha^{-1}
t3 : EFB/TKKS 25 ton ha^{-1}, t4 : EFB/TKKS 30 ton ha^{-1}

Referring to the data, it is known that the application of empty palm oil fruit bunch (EFB) compost does not significantly affect the parameter of the root length of Pak Choy plants. Lakitan (1993) indicates that soil conditions or growth media can influence the root system of plants. Several factors that impact root development include the availability of nutrients and the physical characteristics of the soil itself.

In this study, it is suspected that the root length parameter does not have a significant effect due to two main factors. First, the ultisol soil used in this research contains N nutrient at 0.22%, categorized as moderate, and P at 28.87 mg/100 g, also categorized as moderate. These nutrient levels are already sufficient to support root development, and the roots are capable of absorbing nutrients from the soil to sustain plant growth, even without the addition of EFB, which contains N and K nutrients that meet the Indonesian National Standards (SNI), although growth is not yet optimal. The second factor is that although the composition of EFB has appropriate nutrient values of N and K, meeting the SNI standards and should enhance root development, root growth is hindered by the physical properties of the hard ultisol soil. The high bulk density and low soil porosity cause the soil to compact easily, limiting the penetration or root penetration into the soil. Therefore, it can be concluded that the application of EFB with doses of 15, 20, 25, and 30 tons ha^{-1} has not been able to improve the root growth of Pak Choy plants in ultisol soil.

4. Conclusions

The application of oil palm empty fruit bunch (EFB) compost to ultisol soil has a positive effect on the growth and yield of Pak Choy plants. This is manifested in the increased plant height, increased number of leaves, and increased fresh weight of the plants. However, the effect is not observed in the increased root length of Pak Choy plants. The research results indicate that the optimal dose in the influence of applying oil palm EFB compost on the harvest yield of Pak Choy plants in ultisol soil is treatment t2 with a dose of 20 tons per hectare.

Acknowledgments

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Conflict of Interest

The challenges faced during the implementation of the research include dealing with leaf caterpillar pests, even though their presence is minimal, the presence of rocky soil and undecomposed branches that require thorough cleaning, regular watering to prevent wilting and drying of plants, and vigilance against heavy rain that can damage plants, especially when they are still young.

References

Amri, A. I. (2018). Pemberian Kompos Tandan Kosong Kelapa Sawit dan Zat pengatur Tumbuh Alami Terhadap Pertumbuhan Bibit Kelapa Sawit di Pembibitan Utama Menggunakan Medium Subsoil Ultisol. *Jurnal Agro Teknologi Tropika*. Universitas Riau.

Andalusia, B., Zainabun., dan Arabia, T. (2016). Karakteristik Tanah Ordo Ultisol di Perkebunan Kelapa Sawit PT. Perkebunan Nusantara I (Persero) Cot Girek Kabupaten Aceh Utara. *Jurnal Kawista* 1(1): 45-49.

Darmosarkoro, W. dan Rahutomo, S. (2003). *Tanda Kosong Kelapa Sawit Sebagai Bahan Pembenah Tanah*. Pusat Penelitian Kelapa Sawit. Medan.

Darnoko dan Sembiring, T. (2005). Sinergi Antara Perkebunan Kelapa Sawit dan Pertanian Tanaman Pangan Melalu Aplikasi kompos TTKS Untuk Tanaman Padi. *Pertemuan Teknis Kelapa Sawit 2005*. Peningkatan Produktivitas Kelapa Sawit Melalui Pemupukan dan Pemanfaatan Limbah PKS. Medan 19-20 April.

Hakim, N., Yusuf, M., Lubis, A.M., Ehoni, S., Rudi, M., Hong, G.B. dan Bailey, H. H. (1986). *Dasar Dasar Ilmu Tanah*. Universitas Lampung Press. Lampung.

Irawati, T., Slamet, W. (2017). Pengaruh Umur Bibit dan Umur Panen Terhadap Pertumbuhan dan Produksi Hidroponik NFT Tanaman Selada (*Lactuca sativa* L.) Varietas Grand Rapids. *Jurnal Hijau Cendekia*. Vol. 2. No. 2, Sepetember 2017. P-ISSN : 2477-5096 e-ISSN 2548-9372.

Lahirsin, M., Minwal, dan Gusmiatun. (2017). Pemberian Pupuk Nitrogen dan Kompos Tandan Kosong Kelapa Sawit Untuk Meningkatkan Pertumbuhan Bibit Kelapa Sawit (Elaeis guineensis jacq). STADIA PRE NURSERY. *Journal Klorofil XII* (2). 73-77.

Lakitan, B. (1996). *Fisiologi Pertumbuhan dan Perkembangan Tanaman* . PT. Radja Grafindo Persada. Jakarta.

Lakitan, B. (2012). *Dasar-dasar Fisiologi Tumbuhan*. PT. Radja Grafindo Persada. Jakarta.

MacKinnon, K., G.M. Hatta, H. Halim dan A. Mangalik. (1996). *The Ecology of Kalimantan. Indonesian Borneo*. The Ecology of Indonesia Series Volume III. Periplus Edition. Dalhousie University. 802 p.

Novizan. (2002). *Petunjuk Pemupukan yang Efektif*. Agromedia Pustaka. Jakarta.

Pardosi., Andri, H., Irianto., dan Muksinin. (2014). Respon Tanaman Sawi Terhadap Pupuk Organik Cair Limbah Sayuran Pada Lahan Kering Ultisol. In *Prosiding Seminar Nasional Lahan Suboptimal*. Palembang.

Prasetyo, B. H. dan Suriadikarta, D. A. (2006). Karakteristik, Potensi, Dan Teknologi Pengelolaan Tanah Ultisol Untuk Pengembangan Pertanian Lahan Kering Di Indonesia*. Jurnal Litbang Pertanian: 25(2).*

Sukmawati, S. (2012). *Budidaya Pak Choy* (*Brassica chinensis* L.) *Secara Organik dengan Pengaruh Beberapa Jenis Pupuk Organik*. Karya Ilmiah. Politeknik Negri Lampung. Lampung. 9 hal.

Wahyudi, (2010). *Petunjuk Praktis Bertanam Sayuran*. Agro Media Pustaka. Jakarta.

Wahyuningsih, A., Fajriani, S., & Aini, N. (2017). Komposisi Nutrisi dan Media Tanam Terhadap Pertumbuhan dan Hasil Tanaman Pakcoy (*Brassica rapa* L.) Sistem Hidroponik. *Jurnal Produksi Tanaman,* 4(8), 595-60.

Widiastuti. dan Panji, T. (2007). *Pemanfaatan Tandan Kosong Kelapa Sawit Sisa Jamur Merang* (*Volvaria volvacea*) *(TKSJ) Sebagai Pupuk Orgnaik pada Pembibitan Kelapa Sawit*. Menara Perkebunan, 75 (2) 70-79. Balai Penelitian Bioteknologi Perkebunan Indonesia, Bogor.

Widowati, L. R. (2009). Peranan Pupuk Organik terhadap Efisiensi Pemupukan dan Tingkat Kebutuhannya untuk Tanaman Sayuran pada Tanah Inseptisols Ciherang, Bogor. *Jurnal Tanah Trop.*, Vol. 14, No. 3, 2009: 221-228