Application of coffee husk compost and EM4 on growth and yield of chili pepper (Capsicum Frutescens L.)

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Abstract. This research is intended to comprehend the effect of using waste from coffee husk and EM4 concentration on the growth and yield of chili pepper plants with two factors and repeating 3 times. The research starts from October 2018 to January 2019 by using a factorial randomized block design (RBD), which consisted of two factors namely: The factor of coffee husk waste (K) consisting of 4 levels, while the factor of EM4 concentration consist 4 levels. The research results prove that the waste of coffee husk has a significant impact on the number of productive branches, the number of fruits per plant, and fruit weight per plot. It significantly affects plant height at 45 days after planting (DAP) and stems diameter at 45 days after planting (DAP). The best treatment of coffee husk compost is found in K3 treatment (30 ton/ha). The treatment of EM4 concentration has a good effect on the number of productive branches, the number of fruits per plant, and fruit weight per plot. The best EM4 concentration treatment is found in the B3 treatment (15 mL/L water). The interaction between the coffee husk waste and the EM4 concentration confirms a significant effect on fruit weight per plot. The finest interaction is found in the compost of coffee husk waste 30 ton/ha with a concentration of EM4 15 mL/L water.

1. Introduction

Chili pepper is member of Solanaceae, which has the scientific name Capsicum frutescens L. The chili pepper originates from the American continent, to be exact, in Peru. It spreads to the countries of the Americas, Europe, and Asia, including Indonesia. Chili pepper is one of the chilies that is generally known by the public [1]. In the endeavor to increase the production of chili pepper, soil productivity is the main concern. Low soil fertility has a major impact on the growth and production of chili pepper. The way to improve soil fertility is to add organic matter in the form of compost to the soil.

Coffee husk waste is one of the organic materials that can be used as compost. Roidah [2] declares that compost is an organic matter fermented in a spot protected from sunshine and rain. Its humidity is controlled by watering it when the humidity is too dry. In order to optimize the restructuring, lime can be applied to form compost with a low C/N ratio ready for use.
Coffee husk is a solid waste containing many macro components i.e., nitrogen, phosphorus, and potassium [1]. Coffee husk waste needs to be composed in order to be used immediately for plant production. According to Djuarnani et al. cited in Jumiati [3], composting is a biologically managed method of decomposition of the organic solid waste in aerobic/in the presence of oxygen or anaerobic/oxygen-free conditions.

Meanwhile, Falahuddin et al. [4] affirmed that composting coffee husk waste must be done to reduce the volume of materials with the aim of facilitating application and reduce environmental pollution. Besides, it is also to avoid negative influence on plants due to the high C/N ratio of materials. Following Damanik et al. [5], a worth compost to use is a mature one, characterized by a decrease in compost temperature below 40 °C. Rosniawaty et al. [6] inform that the surplus of composted coffee husk is a nutrient absorbed when coffee creation can be partially restored and reused by plants.

Furthermore, Sutejo et al. [7] confirm that compost is helpful in enhancing soil fertility, in stimulating healthy rooting and in improving soil structure by increasing soil organic material content and optimizing the soil's capacity to retain groundwater content, as well as increasing soil microbial activity that is good for plants and useful for plant disease control.

Berlian et al. [1] uttered that, in general, the amount of organic matter in the soil is less than 3–5% of wet weight and topsoil of mineral soil. This is under Lingga and Marsono [8] opinion that the use of compost as organic fertilizer, the dose is 20 ton/ha depending on the soil's state and the type of planted plant. Its application is made by spreading it around the plant.

Effective usage of coffee husk as a compost provides double advantage. It can obtain compost that can restore soil fertility and reduce environmental pollution due to coffee husk waste. The results of Berlian et al.'s research [1] validated that the addition of 90 grams of coffee husk compost in the planting media produces maximum growth and development to curly chili peppers.

Besides being utilized in compost as decomposing microorganisms (bacteria), programs to increase land productivity and chili pepper production can also be made to implement EM₄ (Effective Microorganism 4) applications. The application of EM₄ is a technology that can be used in agricultural management efforts to reduce negative impacts on the environment. Jumiati [3] explicated that effective microorganisms (EM) are inoculums that can increase the diversity of soil microorganisms beneficial for soil and plant fertility. The microorganisms in EM₄ consist of *Lumbricus* (lactic acid bacteria) and a few photosynthetic bacteria, *Actinomycetes, Streptomyces* sp, and yeast.

Yulhasmir [9] published that EM₄ technology is one of the technology utilization of microorganisms living in the soil that can cooperate synergistically in improving soil fertility rates and the physical properties of the soil. Additionally, Kharisma [10] added that EM₄ can also suppress the growth of pathogenic microorganisms that have always been a problem in monoculture cultivation and continuous cultivation of similar plants (continuous cropping).

In line with Maghfoer et al. [11], the application of EM₄ at a level of 30 l ha⁻¹ can accelerate the process of decomposition of goat excrement, mineralization of nitrogen in the soil, and produce the best eggplant yields. Giving goat manure and urea with EM₄ showed an interaction between the growth and yield components [12].

Similarly, Syafruddin and Safrizal’s research [13] proved that the use of EM₄ at a concentration of 15 ml/l of water with an application time of 14 days could increase the growth and production of chili plants. Moreover, the use of concentrations that will be implemented in this study is based on that research results.

The goal of this research is to determine the effect on the growth and yield of chili pepper plants by the use of coffee husk waste and the EM₄ concentration.

2. Research methodology

This research was taken place in Tangsi Lama Village, Saruway District of Aceh Timiang Regency, in an area height of 10 meters above sea level with a pH of 6.5. The research started from October 2018 to January 2019.
The materials used are fine bran, brown sugar, EM₄ agriculture, topsoil, cow manure, NPK Mutiara fertilizer (16-16-16), pesticide Decis 2.3 EC, Dithane M45, and small polybag with 5 x 7 cm.

The research method uses a factorial randomized block design (RBD) consisting of two factors and repeating 3 times. The first factor is the dose of coffee husk waste compost (K) consisting of four levels: K₀ = 0 ton/ha (control), K₁ = 10 ton/ha (1 kg / plot), K₂ = 20 ton/ha (2 kg / plot), K₃ = 30 ton/ha (3 kg / plot). The second factor is the concentration of EM₄ bioactivator (B) consisting of four levels: B₀ = 0 ml/lt water, B₁ = 5 ml/lt water, B₂ = 10 ml/lt water and B₃ = 15 ml/lt water. There are 16 plants per treatment combination.

Observation data is investigated using analysis of variance with the F test of 1% and 5% levels. Parameters that significantly affect the F test are followed by the Least Significant Difference Test (LSD) at the 5% level.

2.1. Research process
Research starts with soil processing, seeding, nursery media, and composting of coffee husk waste. Provision of the concentration of Bio Activator (Effective Microorganisms) EM₄ according to the concentration is dissolved into 1 liter of water, each B₀ (0 ml/liter water), B₁ (5 ml/liter water), B₂ (10 ml/liter water), B₃ (15 ml/liter of water). This is done by pouring the solvent on the soil surface near the plants' roots with two administration intervals, at planting and three weeks after planting, each with half the application's concentration.

In each plot, four plants are planted according to the experimental arrangement with a spacing of 40 x 60 cm. The whole plant is used as a sample.

2.2. Observation
Observation is made on plant height, number of productive branches per plant, number of fruits per plant (g), and fruit weight per plot (g).

3. Results and discussions

3.1. The effect of coffee husk waste on growth and yield of chili pepper plant height (cm)
The result of the analysis of variance reveals that the effect of coffee husk waste on the chili pepper height has a major impact on the age of 45 days after planting (DAP). However, there is no significant effect on the age of 30 days after planting (DAP). The average height of green bean plants aged 30 and 45 days after planting (DAP) due to the treatment of coffee husk waste in table 1.

Table 1. The average height of chili pepper at the age of 30 and 45 days after planting (DAP) due to using coffee husk waste.

| Compost Dose | Plant height (cm) |
|--------------|-------------------|
|              | 30 DAP          | 45 DAP       |
| K₀ (0 ton/ha) | 34.71           | 57.92 a      |
| K₁ (10 ton/ha)| 34.88           | 58.17 a      |
| K₂ (20 ton/ha)| 37.29           | 59.33 a      |
| K₃ (30 ton/ha)| 36.25           | 63.67 b      |
| LSD 0.05     | ns              | 3.77         |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level. ns=not significant.

Table 1 explains that the highest chili pepper plant is found in K₃ (30 ton/ha), and the lowest plant is in K₀ (control). The result proves that coffee husk waste does not significantly affect plant height at 30 DAP. It is assumed that environmental factors have not been utilized optimally because plant organs have not developed optimally. Kurniawan et al. [14] acknowledge that the plant had not absorbed large
amounts of nutrients and water. The reason is that plant organs have not been formed optimally. Hence, the plants have not shown high growth, which is significantly different between treatments.

At the age of 45 DAP, the result of the LSD test demonstrates that \( K_3 \) (30 ton/ha) is significantly dissimilar from \( K_0 \) (control), \( K_1 \) (30 ton/ha), and \( K_2 \) (10 ton/ha). It is suspected that giving 30 ton/ha of coffee husk waste makes the soil porosity more suitable for the roots to develop properly. The well-developed roots cause the absorption of nutrients and water to take place well to encourage better growth of chili pepper. According to Mustaha et al. [15], Soil porosity is one of the physical properties of the soil that is crucial to know because it is related to aeration and drainage, impacting plant growth. Besides, Sahputra et al. [16] add that coffee fruit husk waste has organic matter and nutrients that improve soil properties.

As said by Hanafiah [17] that organic matter particles are components of pore spaces that have functioned as reservoirs of water and oxygen, as well as space for roots to penetrate. The more pore space will expand the root system, and the roots can more easily absorb nutrients and water in the soil. The optimum water and nutrient absorption would affect the growth in plant height.

### 3.2. The number of productive branches per plant

The finding of the analysis of variance indicates that the usage of coffee husk waste has a substantial impact on the number of productive branches. Table 2 presents the average number of productive chili pepper branches due to using coffee husk waste.

*Table 2. Average number of productive branches of Chili pepper due to using coffee husk waste.*

| Compost dose | Number of Productive Branches (Branch) |
|--------------|----------------------------------------|
| \( K_0 \) (0 ton/ha) | 24.44 a |
| \( K_1 \) (10 ton/ha) | 26.27 a |
| \( K_2 \) (20 ton/ha) | 26.96 ab |
| \( K_3 \) (30 ton/ha) | 29.42 b |
| LSD 0.05 | 2.83 |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.

Table 2 reveals that \( K_3 \) (30 ton/ha) is the largest number of productive branches of chili pepper, whereas \( K_0 \) (control) is the lowest. The finding of the LSD test specifies that \( K_3 \) (30 ton/ha) is considerably different from \( K_0 \) (control) and \( K_1 \) (10 ton/ha), but that is not entirely different from \( K_2 \) (20 ton/ha). The use of coffee husk waste 30 ton/ha of soil moisture is presumed to be more optimal to grow better. Appropriate to Arga et al.’s [18] statement, plants can absorb the nutrient, produce assimilates, and get adequate production levels by maintaining soil moisture. Furthermore, Yakub [19] added that in conditions of adequate water and soil temperature availability, the plants could absorb sufficient water and nutrients and ensure that their physiological processes are well carried out.

### 3.3. The number of fruits per plant

The analysis of variance result points out that the usage of coffee husk waste has an impactful effect on the number of fruits per chili pepper plant. The average number of fruits per chili pepper plant due to using coffee husk waste is shown in table 3.

*Table 3. The average number of fruits per plant of chili pepper due to the using waste of coffee husk.*

| Compost dose | Number of fruits per plant (fruits) |
|--------------|-----------------------------------|
| \( K_0 \) (0 ton/ha) | 255.08 a |
| \( K_1 \) (10 ton/ha) | 282.67 ab |
| \( K_2 \) (20 ton/ha) | 294.71 b |
| \( K_3 \) (30 ton/ha) | 346.48 c |
| LSD 0.05 | 31.74 |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.
Table 3 shows that K₃ (30 ton/ha) has the highest number of productive branches of chili pepper and the K₀ (control) has the lowest number of productive branches. The LSD test result confirms that the use of K₃ (30 ton/ha) differs significantly from using K₀ (control), K₁ (10 ton/ha), and K₂ (20 ton/ha). Thirty tons of coffee husk waste is presumed to increase soil pH to near-neutral pH. Improvement in soil pH to near neutral pH not only provides K availability for plants, but this condition allows all nutrients to be in a state available to plants. K is an element, one of which is needed for photosynthate translocation to the generative parts of plants. The increase in pH that occurs, according to Manuputty et al. [20], is thought to be a reaction of alkaline cations, especially potassium and sodium, which are alkaline metals that form strong bases; besides calcium and magnesium, which are released during the decomposition process. Furthermore, Hanafiah [17] stated that nutrients are available if the soil pH is in the range of 5.5 - 6.5.

3.4. The fruit weight due to the use of coffee husk waste
The result of the analysis of variance authenticates that the distribution of coffee husk waste has a very significant effect on fruit weight per plot of chili pepper (table 4).

Table 4. Average fruit weight per plot of chili peppers due to using of coffee husk waste.

| Compost dose | Fruit weight per plot (gr) |
|--------------|---------------------------|
| K₀ (0 ton/ha) | 826.06 a                  |
| K₁ (10 ton/ha)| 900.62 ab                 |
| K₂ (20 ton/ha)| 972.29 b                  |
| K₃ (30 ton/ha)| 1045.36 b                 |
| LSD 0.05     | 6.74                      |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level

Table 4 displays that the highest fruit weight per chili pepper plot is in K₃ (30 ton/ha) and the lowest in K₀ (control) treatment. The result of the LSD test proves that treatment with K₃ (30 tons/ha) differs significantly from treatment with K₀ (control) and K₁ (10 tons/ha), but it is not markedly different from treatment with K₂ (20 tons/ha). The high fruit weight per K₃ treatment plot of chili pepper (30 ton/ha) is considered optimal for macronutrients, especially P and K, and for micronutrients required by chili pepper plants in order to increase growth and production.

Yulianingrum et al. [21] summarized that if the environment is humid, the decomposition process runs perfectly to increase available phosphorus and potassium in the soil. Furthermore, Lingga and Marsono [8] notified, in the generative phase of the shape of a fruit, such as the number of fruit and fruit weight cannot be separated from the role of nutrients in the soil and the addition of fertilizers.

3.5. The effect of EM4 concentration on growth and yield of chili pepper plant height
The analysis of variance suggests that the EM₄ concentration has a profound impact on chili pepper height at 45 DAP but does not have a considerable impact at the age of 30 DAP. The average height of chili pepper plants aged 30 and 45 DAP due to EM₄ concentrations is presented in table 5.

Table 5 shows that the highest chili pepper plant is set up at B₃ concentration (15 ml / lt water) and the lowest plants at B₀ (control). The result details that the EM₄ concentration is not significantly different on the chili pepper's height at the age of 30 DAP.

The findings of LSD test at the age of 45 DAP reflects the significance that the concentration of B₃ (15 ml/lt water) is considerably different from B₀ (control) but not substantially different from B₂ (10 ml/lt water) and B₁ (5 ml/lt water). The EM₄ concentration of 15 ml/lt of water is assumed to affect the optimal availability of N in the soil so that the absorption of N by plants would also be optimal. The organic nitrogen content of plants would also increase by increasing the absorption of N.
Table 5. The average height of chili pepper plants at 30 and 45 days after planting (DAP) due to EM<sub>4</sub> concentration.

| EM<sub>4</sub> concentration | Plant height (cm) |
|----------------------------|-------------------|
|                            | 30 DAP | 45 DAP |
| B<sub>0</sub> (0 mL/L)     | 34.73  | 57.04  a|
| B<sub>1</sub> (5 mL/L)     | 35.88  | 59.29  ab|
| B<sub>2</sub> (10 mL/L)    | 36.06  | 60.17  ab|
| B<sub>3</sub> (15 mL/L)    | 36.46  | 62.58  b|
| LSD 0.05                   | ns     | 3.77   |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.

Herison et al. [22] enlightened that nitrogen in plants is organic nitrogen compounds. These organic nitrogen compounds in plants play an essential role in various activities of plant growth, including determining cell osmoregulation, transporting of various other nutrients, cell division, maintaining the balance of cations, pH in cells, and various enzymatic reactions. Therefore, the increase in the availability of nitrogen in the soil encourages an increase in plants' organic nitrogen compounds, which can increase plant growth.

3.6. Number of productive branches per plant

The average number of productive branches of chili pepper due to the concentration of EM<sub>4</sub> is given in Table 6.

Table 6. The average number of productive branches of chili pepper due to EM<sub>4</sub> concentration.

| EM<sub>4</sub> concentration | Number of Productive branches (Branch) |
|-----------------------------|--------------------------------------|
|                             | 24.46 a                              |
| B<sub>0</sub> (0 mL/L)      | 25.79 a                              |
| B<sub>1</sub> (5 mL/L)      | 27.65 b                              |
| B<sub>2</sub> (10 mL/L)     | 29.19 b                              |
| B<sub>3</sub> (15 mL/L)     | 2.83                                 |
| LSD 0.05                    |                                      |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.

Table 6 conveys that the highest number of active branches of chili pepper is B<sub>3</sub> (15 ml/l of water), and the lowest is B<sub>0</sub> (control). The LSD test finding confirms that the concentrations of B<sub>3</sub> (15 ml/l water) and B<sub>2</sub> (10 ml/l water) are essentially different from those of B<sub>0</sub> (control) and B<sub>1</sub> (5 ml/l water). It is hypothesized that the concentration of 15 ml/l EM<sub>4</sub> in water has contributed to an increase in phytohormones' production (growth stimulants), which are the guiding factor behind plant growth. The availability of different external hormones results in different responses to enzymes' action in the plant body.

Thus, it will have a different effect on plant growth. According to Suwahyono [23], this is possible because EM<sub>4</sub> is a mixed culture of microorganisms beneficial for plant growth. It consists of photosynthetic bacteria, phosphate solubilizing bacteria, Azotobacter, Actinomycetes, Khamir, and Lactobacillus, useful in decomposing organic materials to increase the availability of nutrients in the soil needed by plants.
3.7. The number of fruits per plant

The analysis of variance clearly shows that the usage of coffee husk waste seems to have a very beneficial effect on the number of fruits per chili pepper plant. The average number of fruits per chili pepper plant due to the concentration of EM₄, as shown in Table 7.

**Table 7. The average number of chili pepper due to the concentration of EM₄.**

| EM₄ concentration | Number of fruits per plant (fruit) |
|-------------------|-----------------------------------|
| B₀ (0 mL/L)       | 259.13 a                          |
| B₁ (5 mL/L)       | 278.50 ab                         |
| B₂ (10 mL/L)      | 308.88 b                          |
| B₃ (15 mL/L)      | 332.33 b                          |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.

Table 7 reveals that the highest number of fruits per chili pepper plant is reported to be B₃ (15 ml/lt water), and the lowest is B₀ (control). The LSD test concludes that the concentrations of B₁ (5 ml/lt water) and B₂ (10 ml/lt water) result in different from B₀ (control) and B₁ (5 ml/lt water). It is assumed that the concentration of B₃ (15 ml/lt of water) is an appropriate concentration that may increase the availability of nutrients, especially P, in the soil.

P nutrient is an essential element in an attempt to increase plant metabolism, especially the generative phase. Adequate the need for P nutrients will encourage an increase in the number of chili pepper. This is following Amanillah's statement [24], that the increase in Phosphorus levels is thought to be the impact of Lactobacillus activity, which converts glucose in organic matter into lactic acid, so then the environment becomes acidic, which causes phosphate that is bound in long chains to dissolve in organic acids produced by these microorganisms.

3.8. The fruit weight due to the use of EM₄

The findings of the analysis of variance indicate that the concentration of EM₄ has a powerful effect on the fruit weight per chili pepper plant. The average fruit weight per chili pepper plot due to the concentration of EM₄, as shown in Table 8.

**Table 8. The average fruit weight per plot of chili pepper due to EM₄ concentration.**

| EM₄ concentration | Fruit weight per plot (gr) |
|-------------------|----------------------------|
| B₀ (0 mL/L)       | 808.51 a                   |
| B₁ (5 mL/L)       | 907.14 ab                  |
| B₂ (10 mL/L)      | 979.26 b                   |
| B₃ (15 mL/L)      | 1049.42 b                  |

Note: The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.

Table 8 shows that the highest fruit weight per plot of chili pepper is found at the B₃ concentration (15 ml/lt water) and the lowest at B₀ (control). The LSD test result summarizes that the concentrations...
of B$_3$ (15 ml/lt water) and B$_1$ (10 ml/lt water) are significantly different from B$_0$ (control) and B$_1$ (5 ml/lt water). It is assumed that the increase in EM$_4$ concentration can enhance the diversity of soil microorganisms and increase their activity in the soil so that the soil's biological conditions are better.

Good P and K nutrients will further increase the weight of the chili pepper. It is in line with the statement of Yulhasmir et al. [9] that the microorganism culture contained in EM$_4$ contains fermentation and synthetic bacteria, which can stimulate and accelerate the fermentation process and decomposition of organic matter so that the nutrients contained in organic matter will be quickly available and absorbed for plant growth. According to Higa [25], EM$_4$ application can improve soil physical and chemical properties and increase microbial diversity, soil fertility, nutrient absorption, improve quality and yield. Furthermore, Saragih and Ardian [26] add that plants would grow well if the nutrients are needed sufficient available in a form easily absorbed by plants and supported by loose soil structure conditions.

### 3.9. The effect of interaction of coffee husk waste and EM$_4$ concentrations

The finding reveals an interaction between the two treatment combinations, namely the use of coffee husk waste and the concentration of EM$_4$ in fruit weight per plot of chili pepper. However, there is no interaction between the two treatment combinations at plant height (age 30 and 45 DAP), the number of productive branches, and the number of fruits per plant. Table 9 represents the average fruit weight per chili pepper plot due to the interaction between using coffee husk waste and the concentration of EM$_4$.

**Table 9.** The average fruit weight of the chili pepper plant due to the interaction between using coffee husk waste and the concentration of EM$_4$.

| Treatment | Fruit weight per crop plot (gr) |
|-----------|---------------------------------|
| K$_0$B$_0$ | 643.84 a                        |
| K$_0$B$_1$ | 834.33 abcd                     |
| K$_0$B$_2$ | 926.87 bcde                     |
| K$_0$B$_3$ | 899.19 bcde                     |
| K$_1$B$_0$ | 718.52 ab                       |
| K$_1$B$_1$ | 984.28 cde                      |
| K$_1$B$_2$ | 883.22 bcd                      |
| K$_1$B$_3$ | 1016.47 de                      |
| K$_2$B$_0$ | 861.50 bcd                      |
| K$_2$B$_1$ | 1020.93 de                      |
| K$_2$B$_2$ | 1002.82 de                      |
| K$_2$B$_3$ | 1003.92 de                      |
| K$_3$B$_0$ | 1010.19 de                      |
| K$_3$B$_1$ | 789.00 abc                      |
| K$_3$B$_2$ | 1104.15 ef                      |
| K$_3$B$_3$ | 1278.08 f                       |

LSD 0.05 209.60

*Note:* The numbers followed by the same letter in the same column are not significantly different in the LSD test at the 0.05 level.
Table 9 indicates that the maximum fruit weight per plot of chili pepper is detected in the combination of $K_B3$ treatment (30 ton/ha coffee husk waste and 15 ml/liter water EM$_4$ concentration). The findings of the LSD test reveal that the fruit weight per plot of chili pepper in the $K_B3$ treatment combination is substantially different from the treatment combination of $K_0B_0$, $K_0B_1$, $K_0B_2$, $K_0B_3$, $K_1B_0$, $K_1B_1$, $K_1B_2$, $K_1B_3$, $K_2B_0$, $K_2B_1$, $K_2B_2$, $K_2B_3$, $K_3B_0$, $K_3B_1$, $K_3B_2$, $K_3B_3$, but not significantly different from those of $K_1B_3$. It is speculated that the interaction between coffee husk waste compost and EM$_4$ concentration can increase the fruit weight of chili pepper because coffee husk waste compost may boost soil physical properties to help the roots grow properly. The function of the microorganisms found in EM$_4$ will then work optimally in the decomposition of organic matter.

In compliance with Bahri and Suryo’s opinion [27], the use of bio-fertilizers can increase microbes’ availability in the soil because then the soil is better biologically. Furthermore, Sasli [28] stated that EM$_4$ contains microbes beneficial to the soil, such as bacteria that crash N, P, and decompose organic matter.

4. Conclusions and suggestions

4.1. Conclusion

1. The use of coffee husk waste compost had a major impact on the amount of productive branches, the number of fruit per plant and the weight of fruit per plot. It had a significant effect on plant height at 45 DAP and had insignificant impact on plant height at 30 DAP. The highest finding for the treatment of coffee husk waste compost were seen in the treatment of $K_3$ (30 ton/ha).

2. The treatment of the concentration of EM$_4$ had a very considerable impact on the number of productive branches, the number of fruit per plant and the weight of fruit per plot. It also had a big impact on plant height at 45 DAP but had no considerably effect on plant height at 30 DAP. The optimal concentration treatment for EM$_4$ was found in treatment with $B_3$ (15 ml/liter water).

3. The interaction between coffee husk waste compost and the concentration of EM$_4$ greatly affects fruit weight per plot. The optimum interaction is detected in the 30 ton/ha compost waste of coffee husk with a concentration of 15 ml/liter of EM$_4$ water ($K_B3$).

4.2. Suggestion

1. In order to achieve optimum growth and yield of chili pepper, it is advised that compost containing 30 tons/ha of coffee husk waste with an EM$_4$ concentration of 15 ml/liter of water be used.

2. Considering that this research aspect has a limitation, other researchers should carry out the same research to treat coffee husk compost and a more varied concentration of EM$_4$.

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