

The Effectiveness of Coffee Leather Organic Fertilizer on The Productivity of Red Spinach (*Amaranthus Tricolor L.*)

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ABSTRACT

*The study to determine the effect of variations in the composition of organic fertilizer from coffee husks on the productivity of red spinach (*Amaranthus tricolor L.*), using a completely randomized design (CRD) with one control and four treatment combinations with six repetitions carried out for 30 days. Productivity includes the height and wet weight of red spinach. Data were analyzed using Multivariate Analysis of Variance (MANOVA). In conclusion, the application of coffee husk organic fertilizer has a significant effect on the growth and productivity of red spinach, the best dose of treatment is P3 = 50% coffee husk + 12.5% leaf waste + 25% livestock manure + 12.5% husk charcoal.*

Keywords: *coffee skin, productivity, red spinach.*

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PRELIMINARY

Red spinach is widely consumed by people as a vegetable, the nutritional content in red spinach provides many benefits for those who consume it. The existence of red spinach as one of the vegetables is very much needed in improving people's nutrition because it contains lots of protein, vitamin A, vitamin C, carbohydrates, fats, and mineral salts which are needed by the human body (Utami & Asngad, 2016).

The most basic reason someone consumes spinach is for health. To get healthy red spinach, it is necessary to pay attention to the use of fertilizers in growing spinach. Fertilizer is a nutrient source that is used as a nutrient intake for the growth of the spinach plant. In order not to harm health due to the use of clams in plant maintenance, it is necessary to use organic fertilizers that have a lower potential for pollution. The use of organic

Fertilizers can improve not only soil structure but also increase soil productivity. One of the organic materials that can be used as the main ingredient for making organic fertilizer is coffee husks. The coffee skin comes from the residue of the grinding usually just thrown away or as useless waste (Islam, 2018).

Coffee is the main plantation product that is mostly produced in Lampung Province, both for export and for processing as raw material for domestic production (Sutanto et al., 2020). The high yield of coffee in Indonesia has an impact on the large amount of coffee husk waste produced in coffee bean processing. Along with the increase in coffee production, there was also an increase in coffee skin waste. Coffee peels contain nutrients such as nitrogen, phosphorus, and calcium, which are useful if used as compost material, the high waste of coffee skins is made a breakthrough by making coffee husk waste as organic fertilizer. Utilization of coffee husk waste can be done using bioremediation techniques so that the result is in the form of organic

fertilizer which can be used as a source of plant nutrition and reduce the use of chemical fertilizers (Sutanto, et al, 2019). Bioremediation techniques can be carried out by utilizing certain microbial consortia, one of the tested microbial consortia is pumakkal. Pumakkal (Biang, a starter in Lampung language) is a consortium of pineapple liquid waste indigenic bacteria (PLW), which are bacteria that have the potential to rot and can be used as a starter in waste recovery (Sutanto, 2019). The advantage of coffee husk compost is that its nitrogen content is relatively high, which is around 6% so that coffee husk compost can be a source of nitrogen for plants. (Sutanto et al., 2020).

The application of the results of this research is expected to be used as a learning resource. Education always requires the latest information because science is continually evolving. The results of this study have the potential as alternative teaching material in Biology subjects in Senior High Schools (SMA) in the form of practicum guides. Practicum guide is one form of teaching material that has the potential to be a guide in a series of learning activities to provide direct experience to students.

RESEARCH METHODS

This research is an experimental study because to determine the effect of variations in the ratio of organic fertilizer composition of coffee husks on the growth and productivity of red spinach (*Amaranthus tricolor L*). This study used a completely randomized design (CRD) with one control and four treatment combinations.

P0 = Planting media without fertilizer.

P1 = 100% fertilizer made from coffee husks.

P2 = 50% coffee skin + 25% leaf waste + 12.5% manure + 12.5% husk charcoal.

P3 = 50% coffee husk + 12.5% leaf waste + 25% livestock manure + 12.5% husk charcoal.

P4 = 50% coffee husk + 12.5% leaf waste + 12.5% manure + 25% husk charcoal.

In this study, the sampling technique used was saturated sampling technique, namely taking all members of the population as samples, namely 30 experimental red spinach plants from 4 treatments and one control which were repeated six times.

The analysis used to determine the effect of organic coffee peel fertilizer on the growth and productivity of red spinach was the Multivariate Analysis of Variance (MANOVA), which previously carried out prerequisite tests, namely the normality test and the variance homogeneity test.

RESULTS AND DISCUSSION

The results of the research on the application of coffee husk organic fertilizer, the growth and productivity of red spinach (*Amaranthus tricolor L*) were observed in two aspects, namely red spinach plant height and wet weight. The results obtained in the form of data on the height and wet weight of the plant then performed a parametric statistical test, namely the Multivariate Analysis of Variance (MANOVA) test.

Growth in red spinach was observed through the increase in plant height, and the productivity of red spinach was observed through wet weight at the end of harvest. Based on the results of the multivariate analysis of variance (MANOVA) parametric hypothesis test, the first hypothesis is accepted, namely the coffee husk organic fertilizer affects the growth and productivity of red spinach. The first hypothesis is acceptable because, in the Multivariate test table, the sig value is obtained. $0.001 < \text{from } 0.05$ then H_0 is rejected, which means that there is a difference in growth (Y1) and productivity (Y2) between P0, P1, P2, P3, and P4.

Plant growth and productivity are influenced by two main factors, namely, internal factors and external factors. Internal factors include genes and hormones, and external factors include environmental conditions for plant growth. The successful growth of a plant is closely related to the environmental

conditions in which it grows so that optimal environmental conditions are needed to support the growth and development of the plant. External/environmental factors that affect plant growth include temperature, climate, light and also the availability of nutrients.

Rina, (2015) states that plants are not only controlled by internal factors but are determined by external factors. One of these external factors is essential nutrients. Essential nutrients are the elements necessary for plant growth. Some of the nutrients that are needed for plants are Nitrogen (N), Phosphorus (P), Potassium (K). Each of these elements has a different role to play in plant growth. One of the most influential external factors is the availability of nutrients and nutrients in the planting medium. Nutrient content in planting media such as N, P, K, and other organic materials can accelerate metabolism or otherwise slow down metabolism in the plant body. As it was said by (Agustina, 2004) that the nutritional status of plants that affect plant growth and yield is in a zone of deficiency (deficiency), a zone of insufficiency, or zone of poisoning (excess). The application of organic coffee husk fertilizer is a strategic method used to create environmental conditions that support the growth process and to increase productivity. The content of N, P, K in organic matter added to the planting medium functions to accelerate the process of increasing height, leaf width, stem circumference, and weight in red spinach plants. Millya (2007) states that nitrogen is the builder of essential compounds such as chlorophyll, nucleic acids, and enzymes. Therefore nitrogen is needed in the formation of shoots and the development of stems and leaves. That is what was said by (Wijiyanti et al., 2019) that the availability of sufficient nutrients would help increase plant growth such as height gain and leaf formation, thus affecting the plant's wet weight. Fulfilling the need for nutrients in plants will help accelerate the growth process of a plant, especially during the vegetative period of spotted formation and the development of stems and leaves.

Composition of organic fertilizer for fermented coffee bark with pumakkal which provides the most optimal effect on the growth of red spinach (*Amaranthus tricolor L.*). The results of the statistical analysis carried out showed that the application of organic fertilizer from fermented coffee husks using the Pumakkal microbial starter had an effect on plant height increase. Red spinach (*Amaranthus tricolor L.*). Can be seen in Figure 1.

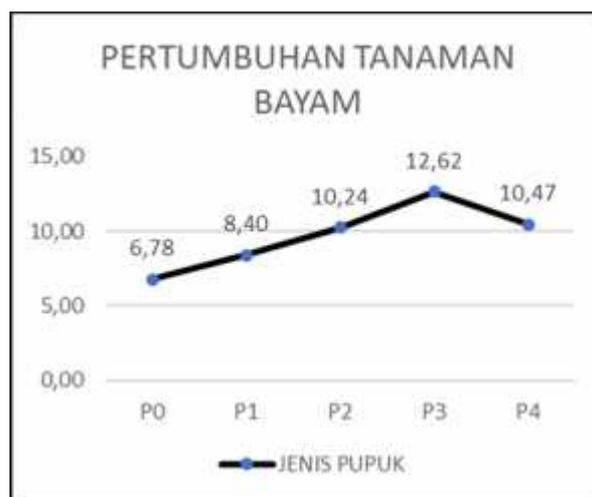


Figure 1. Average Height of Red Spinach Plants

The application of coffee husk organic fertilizer has an effect on the height of red spinach plants, organic fertilizer given as a mixture of growing media has a different composition. Comparisons are given between P0, P1, P2, P3, and P4. The optimal results obtained are at P3 (50% coffee skin + 12.5% leaf + 25% goat manure + 12.5% husk charcoal) with an average height measurement of 14.45 cm. Thus the fourth

hypothesis is for height. Spinach plants are accepted, namely the composition of P3 coffee husk organic fertilizer provides an optimal effect on the growth of red spinach (*Amaranthus tricolor L.*).

The application of organic coffee husk fertilizer with variations such as in P3 dramatically affects the growth of spinach. This is due to the high content of N, P, and K nutrients. The content of each of these nutrients has different functions in influencing the acceleration of growth. Like the elements Nitrogen and Pospor, Mukhlis (2017) states that the presence of the element N (Nitrogen) in collaboration with the element P (phosphorus) to influence the growth of the red spinach plant, nitrogen has the primary function of synthesizing chlorophyll, protein and amino acids so that these amino acids are needed in large quantities during the period vegetative.

According to (Sari et al., 2017)states that the cell division process will run quickly in the presence of sufficient N elementst. Elementst N has the main function to stimulate overall growth and especially stem growth which will stimulate plant height growth. The element Nitrogen helps in the photosynthesis process, which results from photosynthesis will be translocated to all parts of the plant body. However, nitrogen cannot work alone, and nitrogen needs help from potassium to meet one of the raw material needs for photosynthesis, namely, carbon dioxide. Potassium can absorb carbon dioxide in the environment around it. Setiawan (2016: 67) states that the element potassium functions to increase the absorption of carbon dioxide, move sugars to the formation of starch and protein, helps open and close the mechanism of stomata.

Fahmi et al., (2010) He stated that nitrogen and phosphorus are nutrients that are needed if the plant is deficient in these nutrients, its growth will be stunted, and the plant will become stunted. So that the fulfillmentt of the nutrient needs of a plant, and assisted by the presence of sufficient sunlight, photosynthesis will run well. Photosynthesis that takes place optimally will produce optimal photosynthate as well so that it has an impact on the growth of red spinach which has increased growth in the form of plant height growth.

Composition of organic fermented coffee skin fertilizer with pumakkal which provides the most optimal effect on the productivity of red spinach (*Amaranthus tricolor L.*). The results of the statistical analysis carried out showed that the application of organic fertilizer from fermented coffee peels with Pumakkal affected plant productivity Red spinach (*Amaranthus tricolor L.*) can be seen in Figure 2.



Figure 2. Average Wet Weight of Red Spinach Plants

The application of coffee husk organic fertilizer has an effect on the wet weight of the red spinach plant, Organic fertilizers that are given as a mixture of planting media has different compositions.

Comparisons are given between P0, P1, P2, P3, and P4. The optimal results obtained are at P3 (50% coffee skin + 12.5% leaf + 25% goat manure + 12.5% husk charcoal) with the highest wet weight measurement of 0.0146 kg. Thus the fourth hypothesis is for spinach plant productivity. Accepted, namely the composition of the third coffee husk organic fertilizer has an optimal effect on the productivity of spinach (*Amaranthus tricolor L.*).

The wet weight of a plant is influenced by the availability of sufficient nutrients to help increase growth and leaf formation and enlargement of the plant stems. Harjadi et al., (2007) states that the availability of nutrients in the planting medium plays a vital role in influencing the wet weight of a plant. This can happen because plants that get enough nutrients, the photosynthesis process will run well, and will produce good photosynthate too, so that growth will increase, of course, followed by increased wet weight.

Noviansyah & Chalimah, (2015) stated that the weight of a plant is basically influenced by plant height and the number of leaves that undergo photosynthesis, the more the number of leaves, the photosynthesis process will run well. The high process of photosynthesis will produce more incredible energy for plant growth and development. The wet weight of a plant can also be used as an indicator of growth because the wet weight shows the plant yield obtained from the total growth and development of the plant during its life.

CONCLUSION

There is an effect of the application of organic coffee husk fertilizer on the productivity of red spinach (*Amaranthus tricolor L.*) P3 coffee peel organic fertilizer has the best effect on the growth of red spinach (*Amaranthus tricolor L.*) P3 coffee peel organic fertilizer affects the production of red spinach (*Amaranthus tricolor L.*).

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