

Response of Pakcoy Plant Growth and Production to the Application of POC and Manure

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Abstract

Pakcoy (*Brassica rapa* L.) is a type of vegetable plant is used by people in various dishes because it contains minerals, protein, Vitamin A, Vitamin B, Vitamin B2, Vitamin B6, Vitamin C, potassium, phosphorus, copper, magnesium, iron, carbohydrates and fiber. This research aims to see the effect of giving POC and chicken manure on the growth and production of pakcoy plants. This research was carried out using a factorial Randomized Block Design (RAK) which consisted of two factors, namely the concentration of chicken manure which consisted of 3 levels, namely $A_0 = 0$ kg / plot, $A_1 = 1$ kg / plot, $A_2 = 2$ kg / plot, and $A_3 = 3$ kg / plot. The second factor is the POC dose which consists of 4 levels, namely. $E_1 = 10$ ml/liter water/m², $E_2 = 20$ ml/liter water/m² and $E_3 = 30$ ml/liter water/m². The results showed that the application of chicken manure had no significant effect on the number of leaves, wet harvest weight per plot, wet harvest weight per hectare, wet sale weight per hectare. The interaction between giving chicken manure and POC had a significant effect on the number of leaves, wet weight of harvest per plot, wet weight of harvest per hectare, wet weight of sale per hectare.

Keywords— Chicken Manure, POC, Pakcoy

Introduction

Pakcoy (*Brassica rapa* L.) is a type of vegetable plant that belongs to the Brassicaceae family. The pakcoy plant is used by people in various dishes because it contains minerals, protein, Vitamin A, Vitamin B, Vitamin B2, Vitamin B6, Vitamin C, potassium, phosphorus, copper, magnesium, iron, carbohydrates and fiber. Pakcoy plants have high nutritional content that is needed by the body (Jayanti, 2020). The problem faced by Pakcoy plant cultivators is that the chemical fertilizers used tend to be expensive due to the use of synthetic chemical fertilizers which are widely used both on a small and large scale (Munar *et al.*, 2018). Organic farming is a system for returning all types of organic material to the soil, both in the form of agricultural waste, household waste and livestock waste, which in turn aims to provide food for plants to grow well (Kamsurya dan Botanri, 2022). Organic fertilizer is micro and macro plant nutrients made from plants, animal waste and organic waste (Asmawanti *et al.*, 2022).

One substance that can speed up the decomposition process of organic fertilizer is eco

enzyme. Eco enzyme is the result of fermentation of organic waste. environmentally friendly eco-enzyme liquid, made from fermented kitchen waste or fresh organic waste which can be used as local organic fertilizer for farmers (Sari *et al.*, 2021). Eco enzyme is a complex organic solution produced from the fermentation process of organic fruit and vegetable waste with the addition of water and brown sugar. The fermented eco enzyme solution will produce a multifunctional liquid. Eco enzyme can function as an organic liquid fertilizer that contains nitrogen and nutrients for plants so that it can be used to increase plant fertility. Providing eco enzyme can be successful if the right fertilizer is given so that it can support the successful growth of Pakcoy plants (Prasetiawati *et al.*, 2023). Utilizing waste into eco-enzymes as organic fertilizer is one effort to protect land ecosystems, but there are still many farmers who don't know about the use of eco-enzymes as organic fertilizer (Larasati *et al.*, 2020).

POC is a liquid extract produced from fermenting leftover vegetables and fruit with brown sugar as a substrate. The principle of the process of making eco enzyme itself is actually similar to the process of making compost, but water is added as a growth medium so that the final product is a liquid which is preferable because it is easier to use. Liquid organic fertilizer makes it easier for plants to provide and absorb the nutrients contained in it and does not cause damage to the soil but rather improves soil structure (Asmawanti *et al.*, 2022). Liquid organic fertilizer makes it easier for plants to provide and absorb the nutrient elements contained in it and does not cause damage to the soil but rather improves the soil structure. The process of making liquid organic fertilizer is carried out by fermentation, where the fermentation process can be carried out anaerobically or aerobically with the addition of microorganisms which are able to change chemical compounds into organic substrates to accelerate degradation (Tanti *et al.*, 2019). Apart from liquid organic fertilizer, manure that can be used to overcome planting problems is chicken manure. Chicken manure is an organic fertilizer derived from chicken manure which is composed of living creature material that goes through a weathering process based on biological recycling. Nutrient recycling can be done through plant and livestock waste, as well as other waste that can improve soil fertility status (Sitorus, Panataria, Simanjuntak, et al., 2023)(Kamsurya dan Botanri, 2022).

Several research results show that the application of chicken manure fertilizer always provides the best plant response in the first season. This happens because chicken manure decomposes relatively quickly and has sufficient nutrient levels when compared with the same number of units as other fertilizers. Providing solid chicken manure fertilizer will increase the uptake of nutrients by plant roots, because the soil structure and aggregates will improve. Improving soil structure and aggregates will improve the plant root system, resulting in better nutrient absorption which will encourage plant vegetative growth, so that maximum production can be achieved (Saragih et al., 2024)(Gayatri *et al.*, 2022).

Research Method

The materials used in this research were green variety pakcoy seeds, chicken coop fertilizer, eco-enzyme, Dithane M-45 fungicide, Decis 25 EC insecticide and water. The tools that have been used in this research are hoes, tripe, machetes, rakes, sticks, buckets, measuring tapes, gembors, hoses, calculators, analytical scales, calipers, rulers, wooden stakes, plates, nails, large brushes, painting brushes, hammers, plastic ropes, banners and stationery. This research was carried out using a factorial Randomized Block Design (RAK) which consisted of two factors, namely the concentration of chicken manure which consisted of 3 levels, namely $A_0 = 0$ kg / plot, $A_1 = 1$ kg / plot, and $A_2 = 2$ kg / plot and $A_3 = 3$ kg / plot. The second factor is the POC dose which consists of 4 levels, namely. $E_1=10$ ml/liter water/m², $E_2= 20$ ml/liter water/m² and $E_3=30$ ml/liter water/m². To determine the influence of the factors being tried and their interactions, the experimental data were analyzed using variance. The results of the analysis of variance which had a significant effect were followed by the Duncan distance test at the test level $\alpha = 0.05$.

Literature Review

Pakcoy is a plant from the Cruciferae family, still in the same genus as white mustard/pets and green mustard/claim. Pakcoy is a variety of mustard greens whose leaves are used as a vegetable. Pakcoy comes from the Asian continent, namely from China and East Asia. The nutritional content of pak choy mustard greens is excellent, especially for pregnant women, because it can prevent anemia. Apart from that, Pakcoy mustard greens can ward off hypertension and heart disease and reduce the risk of various types of cancer (Afriyanti, 2022).

Pakcoy mustard greens are also helpful in eliminating the itchy feeling in the throat in cough sufferers, curing headaches, cleansing the blood, improving kidney function, and improving and facilitating digestion; the seeds are used as oil and a food spice. The contents of pak choy mustard greens are protein, fat, carbohydrates, Ca, P, Fe, Vitamin A, 6, Vitamin B, and Vitamin C (Simanjuntak, 2017; Tajuk, 2024).

Pakcoy mustard greens are vegetable plants that require more nitrogen nutrients for their growth or are often called heavy feeders (Pracaya, 2007). Mustard plant fertilizer requirements per hectare are 300 kg urea (138 kg N), 200 kg SP-36 (72 kg P), and 100 kg KCl (Tampubolon, 2022).

The fertilizer usually given in the cultivation of Chinese/mustard plants is only N (urea) and P (SP-36) in a ratio of 2:1. Fertilization of the N element is given in stages twice. In contrast, P fertilization is given once, along with the first fertilizer of the N element. However, some only provide N elemental Fertilization at a dose of 250-300 kg of urea per hectare because Chinese cabbage is a plant that requires more nitrogen nutrients (Putri, 2019).

Chicken manure is an organic fertilizer composed of living creature material that goes through a weathering process based on biological recycling. Nutrient recycling can be done through plant and livestock waste and other waste that can improve soil fertility status (Notohadiprawiro et al., 2022).

One of the roles of organic fertilizer is that it can improve soil's physical, chemical, and biological properties. Applying organic fertilizer in the cropping system can increase the soil's organic/C-organic material content and total N content (Zulkarnain et al., 2016). The ratio of N and C-organic soil is critical because it relates to breaking down organic matter in the soil and providing N for plants. The quality standards for soil organic matter content are N 0.21-0.50%, C-organic 2.01-3.00% and C/N ratio 11-15 (Sembiring, 2017). Another function of organic fertilizer is to increase cation exchange capacity so that the soil can provide or receive cations and nutrients or plant nutrients (Tampubolon, 2022).

POC is a liquid extract from fermenting leftover vegetables and fruit with brown sugar as a substrate. The principle of making eco-enzyme itself is similar to the process of making compost. However, water is added as a growth medium so that the final product is a liquid, which is preferable because it is easier to use. Making liquid organic fertilizer (POC) requires mixed materials such as bioactivators for decomposing bacteria to decompose vegetable waste, which is used to meet the nutrient needs of plants, and molasses or brown sugar functions as food/activator for the decomposer bacteria in Boisca (Prarikeslan et al., 2023).

According to (Wahyuni et al., 2019), organic waste is goods considered unusable and thrown away by the previous owner/user. However, it can still be used if managed using the correct procedures and is one of the ingredients for making charcoal pellets. Particular market waste, such as vegetable markets, fruit markets, or fish markets, is relatively uniform in type;

most of it (95%) is organic waste, so it is easier to handle. Garbage originating from residential areas is diverse, but at least 75% generally consists of organic waste, and the rest is inorganic.

One of the effects of applying organic fertilizer on the physical properties of the soil is to improve the structure and aggregates of the soil so that the soil's binding capacity to water increases. Providing organic fertilizer increases the number and activity of microorganisms, thereby increasing the decomposition of organic matter. The nutrients contained in organic material become available to plants. Providing liquid organic fertilizer can increase the supply of nutrients to plants. Providing solid chicken manure fertilizer will increase the uptake of nutrients by plant roots because the soil structure and aggregates will improve. Improving soil structure and aggregates will improve the plant root system, resulting in better nutrient absorption and encouraging plant vegetative growth to achieve maximum production. (Marian & Tuhuteru, 2019).

Results and Discussion

Number of Leaves (pieces)

Providing a dose of chicken manure had a significant effect on the number of leaves of pakcoy plants at the age of 1 MSPT and had a very significant effect on the number of leaves at the age of 2 MSPT. This is because the decomposition of chicken manure has gone well so that it is able to supply the nutrients available to plants and also improve soil structure, increase water holding capacity and increase cation exchange capacity which causes better root growth which ultimately can help plants increase their height, plants and number of leaves. This is supported by opinion (Ratriyanto *et al.*, 2019), states that organic fertilizer derived from animal waste has the best structure for plant growth, namely making it easier for water to seep from the soil surface, supporting the life of macro and micro organisms so that the nutrient cycle runs more smoothly. The variance list shows that the interaction between chicken manure and liquid organic fertilizer has a significant effect on plant height at 2 MSPT. The tallest plants found in the treatment combination A₁E₃ were significantly different from A₀E₁ and A₁E₂, but not significantly different from A₀E₂, A₀E₃, A₁E₁, A₁E₃, A₂E₁, A₂E₂, A₂E₃, A₃E₁, A₃E₂ and A₃E₃. The interaction effect of giving chicken manure and liquid organic fertilizer on the number of leaves of pakcoy plants aged 2 WAP can be seen in Figure 1.

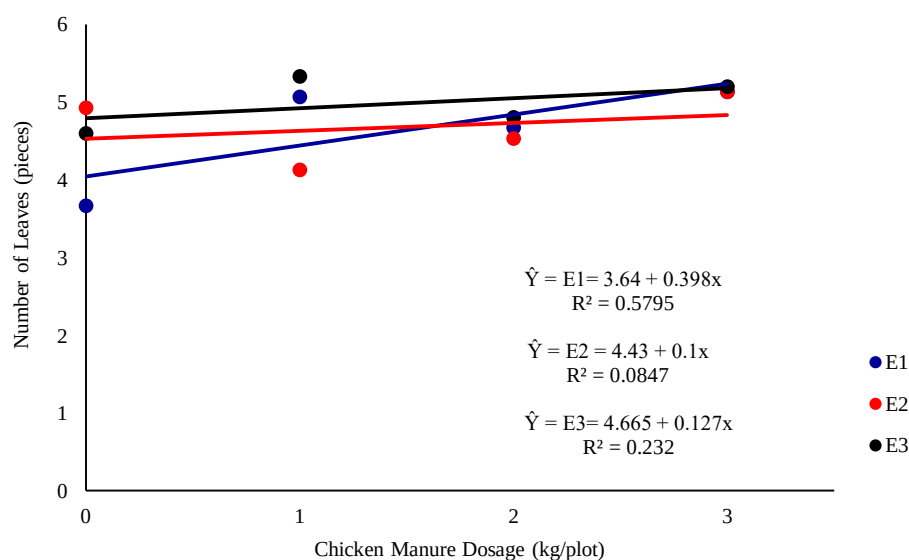


Figure 1. The effect of giving chicken manure on the number of leaves of Pakcoy plants at the age of 2 MSPT.

Figure 1 shows that manure combined with the application of liquid organic fertilizer E₁ and E₃, the growth in the number of leaves has reached the optimum dose, whereas when combined with the application of liquid organic fertilizer E₂, plant leaf growth is still linear. At the concentration of liquid organic fertilizer E₁, the application of chicken manure at a dose of 2.34 kg/plot produces a maximum number of plant leaves of 5.09, while at the concentration of liquid organic fertilizer E₃, the application of chicken manure at a dose of 1.58 kg/plot produces a maximum number of plant leaves of 5.34 pieces. Plants can grow well if their nutritional needs are met. The nutrients needed by plants are nutrients that contain macro nutrients in the form of Nitrogen (N), Phosphorus (P), and Potassium (K), where these nutrients are contained in the POC solution so that they can optimize the growth of Pakcoy plants (Andhika R et al., 2023). The availability of nutrients plays an important role in influencing plant biomass. Wet weight consists of all parts of the Pakcoy plant except the roots. The greater the number of leaves, the greater the wet weight of the plant. As the width of the plant's leaves increases, the fresh weight of the plant will also increase (Warjoto *et al.*, 2020)

Harvest Wet Weight Per Plot (kg)

The application of chicken manure has a very significant effect on the wet weight of the pakcoy crop harvest. This is in line with the significant increase in the number of leaves and pakcoy plants at the age of 1 MSPT, and very significant at the age of 2 MSPT. It is suspected that this is because the chicken manure has decomposed, so that it is able to supply the nutrients available to plants and also improve the soil structure. Chicken manure applied can help improve soil structure and increase soil fertility, so that roots more easily absorb the nutrients contained in the soil, and eco-enzymes can help repel pests, and improve the quality of plants, especially vegetables, so it is good to apply and is good for plant. Eco-enzymes can also have an effect on making soil fertile. In line with opinion Aprilia *et al.*, (2020) states that the availability of sufficient nutrients during growth causes plant metabolism to be more active so that the process of cell elongation and division will be better, which ultimately leads to an increase in plant weight. The variance list shows that the interaction between chicken manure and liquid organic fertilizer has a significant effect on the wet weight of the pakcoy plant harvest. The wet harvest weight of the heaviest pakcoy plants found in the treatment combination A₃E₂ was significantly different from A₀E₁, A₀E₂, A₀E₃, A₁E₁, A₁E₂, A₁E₃, A₂E₁, A₂E₂, A₂E₃ and A₃E₁, but not significantly different from A₃E₃. The interaction effect of providing chicken manure and liquid organic fertilizer on the wet weight of the harvest can be seen in Figure 2.

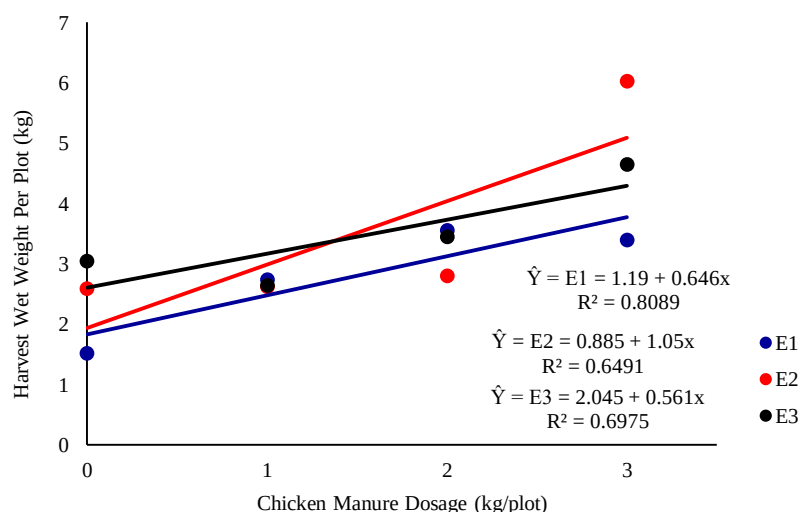


Figure 2. Effect of Providing Chicken Manure on the Wet Weight of Pakcoy Plant Harvest

Figure 2 shows that manure combined with the application of liquid organic fertilizer E_1 produces maximum wet weight of the harvest, whereas when combined with the application of liquid organic fertilizer E_2 and E_3 , the wet weight of the harvest continues to increase with increasing doses of manure. In the combination of E_1 liquid organic fertilizer treatment, application of chicken manure at a dose of 3.54 kg/plot resulted in a maximum wet harvest weight of 2.44 kg. The overall growth of the pakcoy plant can be seen from the wet weight of the plant. Providing nutrition with a balanced nutrient content can optimize the photosynthesis process so that plants get high photosynthesis yields. This is thought to be because the wet weight of the plant will increase as the size of the plant increases. Increasing the number of leaves produced by a plant will increase the fresh weight of the plant (Fatika *et al.*, 2023)

Harvest Wet Weight per Hectare

The variance list shows that the interaction between chicken manure and liquid organic fertilizer has a significant effect on the wet weight of the harvest per hectare. The heaviest wet harvest weight per hectare found in the treatment combination A_3E_2 was significantly different from A_0E_1 , A_0E_2 , A_0E_3 , A_1E_1 , A_1E_2 , A_1E_3 , A_2E_2 , A_2E_3 , A_3E_1 and A_3E_3 , but not significantly different from A_2E_1 . The interaction effect of providing chicken manure and liquid organic fertilizer on the wet weight of the harvest per hectare can be seen in Figure 4.

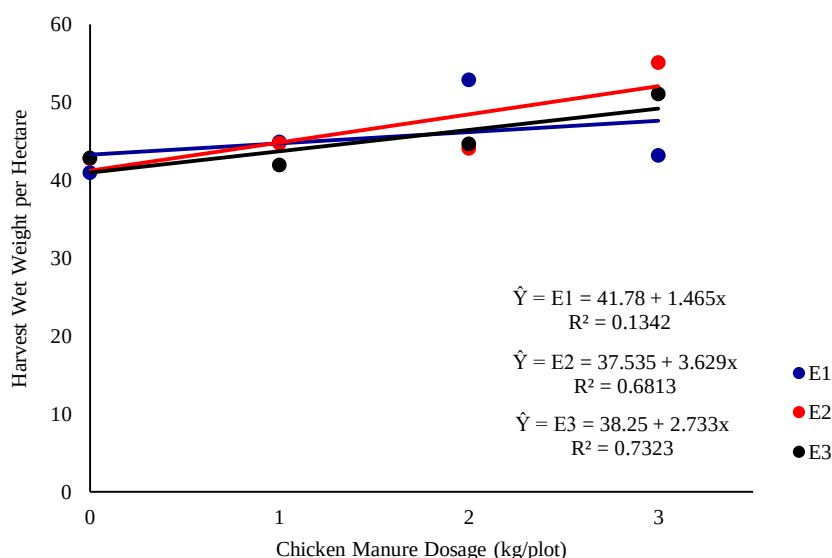


Figure 4. Effect of Providing Chicken Manure on Harvest Wet Weight per Hectare

Figure 4 shows that manure combined with the application of liquid organic fertilizer E_1 and E_3 has reached the optimal dose to increase the wet weight of the harvest per hectare, whereas when combined with the application of liquid organic fertilizer E_2 and E_3 , the wet weight of the harvest continues to increase with increasing application. manure dose. In the combination of E_1 liquid organic fertilizer treatment, application of chicken manure at a dose of 1.72 kg/plot resulted in a maximum wet harvest weight per hectare of 49.83 kg. In the combination of E_3 liquid organic fertilizer treatment, application of chicken manure at a dose of 1.34 kg/plot resulted in a maximum wet harvest weight per hectare of 46.81 kg. Fertilization functions to increase the nutrient content in the soil. Fertilization is very important in plant cultivation, this is because fertilizer can improve the quality and quantity of plants (Koto *et al.*, 2022). Plants need a lot of energy and nutrients to achieve optimal wet weight so that the increase in the number and size of cells can reach optimal levels and also allows for an optimal increase in plant water content. Part of the plant's wet weight

is caused by water content. Water plays a very important role in cell turgidity, so that the cells will enlarge.

Selling Wet Weight per Hectare (tons)

The variance list shows that the interaction between chicken manure and liquid organic fertilizer has a significant effect on the fresh weight sold per hectare. The heaviest wet selling weight per hectare found in the treatment combination A_3E_2 was significantly different from A_0E_1 , A_0E_2 , A_0E_3 , A_1E_1 , A_1E_2 , A_1E_3 , A_2E_2 , A_2E_3 , A_3E_1 and A_3E_3 , but not significantly different from A_2E_1 . The interaction effect of providing chicken manure and liquid organic fertilizer on the fresh sales weight per hectare can be seen in Figure 5.

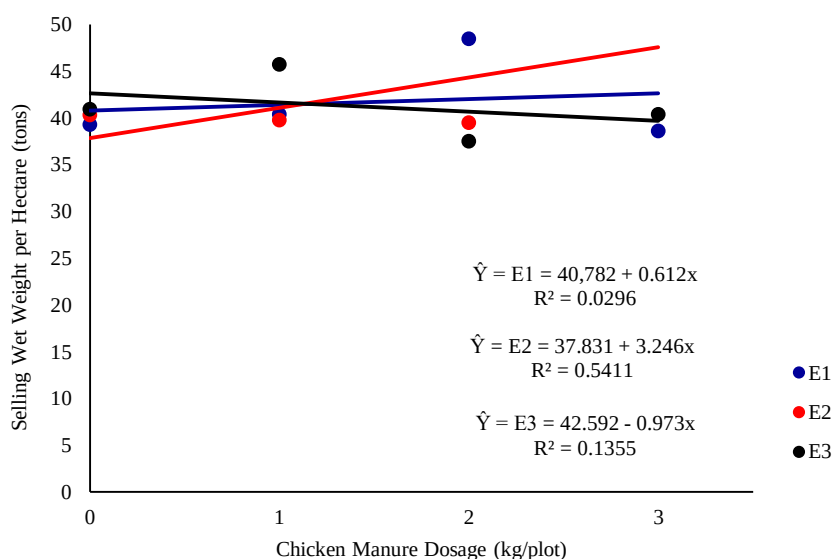


Figure 5. Effect of Providing Chicken Manure on Selling Wet Weight per Hectare

Figure 5 shows that manure combined with the provision of E_1 and E_3 liquid organic fertilizer has reached the optimal dose in increasing the selling wet weight per hectare, whereas when combined with the provision of E_2 and E_3 liquid organic fertilizer, the selling wet weight per hectare still continues to increase. by increasing the dose of manure. In the combination of E_1 liquid organic fertilizer treatment, application of chicken manure at a dose of 1.61 kg/plot resulted in a maximum wet selling weight per hectare of 40.89 kg. In the combination of E_3 liquid organic fertilizer treatment, application of chicken manure at a dose of 0.49 kg/plot resulted in a maximum wet selling weight per hectare of 42.23 kg. If the plant's nutritional needs are met, the plant will receive complete nutrients and can grow with optimal results. The availability of nutrients plays an important role in influencing plant biomass. Wet weight consists of all parts of the Pakcoy plant except the roots. The more leaves, the higher the plant's wet weight (Sitorus, Panataria, Saragih, et al., 2023) (Prasetiawati *et al.*, 2023).

Conclusion

The interaction between giving chicken manure and POC had a significant effect on the number of leaves, wet weight of harvest per plot, wet weight of harvest per hectare, wet weight of sale per hectare.

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