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Earthworm (*Lumbricus) Feeding on Rubellus* and Cabbage Waste on *Purple* Eggplant (*Solanum melongena* L.)

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Abstract

Eggplant *(Solanum melongena* L.*)* is a widely consumed vegetable in Indonesia, both as a fresh salad and in various prepared dishes. This vegetable is rich in nutrients, particularly vitamin A and phosphorus, and can help improve the nutritional diversity of the population. In Riau Province, average eggplant productivity has declined, necessitating improvements to the production system to meet steadily rising demand. This study aims to investigate the interaction between earthworm application and cabbage residue and to identify the combination that produces the best eggplant plants. The experiment used a factorial Completely Randomized Design (CRD) with two factors. The first factor was earthworm application (0, 20, and 30 earthworms per polybag). The second factor was cabbage residue application (0, 420 g, and 630 g per polybag). The observed parameters included plant height, days to flowering, days to first harvest, fruit length, fruit diameter, and fruit weight. The data were statistically analyzed using analysis of variance (ANOVA); if the calculated F-value exceeded the table F-value, the analysis continued with Duncan's New Multiple Range Test (DNMRT) at the 5% significance level. The results showed that there was no significant interaction between the two factors for any of the observed parameters. However, individually, the application of 30 earthworms and 630 g of cabbage waste tended to produce the best growth and yield. Based on the research results, it is recommended to use a combination of 30 earthworms and 630 g of cabbage waste.

Keywords: Fertilizer, Growth, Organic Matter, Production, Soil Macrofauna

1. Introduction

Eggplant (*Solanum melongena* L.) is a type of vegetable that is classified in the Solanaceae family. Eggplant fruit is liked by society and consumed as fresh vegetables and processed to become various types of culinary products. According to Sulardi *et al.* (2022) in 100 g of fruit eggplant contains 28 calories Energy , 1.1 g protein, 0.2 g fat, 5.5 g carbohydrates , 2.1 g fiber , 0.04 mg vitamin B1, 0.03 mg vitamin B2, 5 mg vitamin C. Contents adequate nutrition tall make eggplant Enough potential developed as contributor diversity nutrition public .

Based on data from the Director General of Horticulture (2024), the average eggplant productivity in Riau Province in 2022 was approximately 10.47 tons per hectare (t/ha). However, it declined to 8.62 t/ha in 2023. Eggplant productivity in Riau Province is declining, indicating a need in improve the cultivation system. Additionally, this low productivity is partly caused by the condition of marginal lands, such as Inceptisol soils. Inceptisols are young soils with low fertility and low organic matter content. Low organic matter results in poor soil stability and aggregate formation, making the land easily eroded and hampering infiltration and permeability. Reduced infiltration lowers the soil's ability to retain water, causing the land to dry out quickly. Efforts to improve the planting medium for purple eggplant include repairing the soil's physical and chemical properties, one of which involves utilizing earthworms. Earthworms play a vital role in improving soil chemistry, physics, and biology. They act as decomposers, helping to cycle nutrients back into the ecosystem in forms that plants easily absorb.

Earthworm soil contains both macro- and micronutrients, with the nutrient content depending on the organic matter consumed by the earthworms and the type of soil. Utilizing earthworms as biological activators naturally improves soil properties, as they derive their

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energy from organic material. One form of organic material used is cabbage waste.

Research by Sugara et al. (2020) showed that adding 10% cabbage waste increased organic matter digestibility to 47.83%. The purpose of this study is to understand the effects of interactions between earthworm soil and cabbage waste, as well as the individual effects of each factor. The goal is to determine the combination of earthworm soil and cabbage waste that produces the best growth of eggplant plants.

2. Material and Methods

The study was conducted at the experimental garden of the University of Riau, Campus Binawidya, Pekanbaru City. The location is geographically situated at coordinates 0°28'49.29"N and 101°22'45.97"E, with an elevation of 12 meters above sea level. The research period spanned from January to April 2025.

The materials used in the study included: purple eggplant seeds of the Yuvita F1 variety, earthworm soil (Lumbricus rubellus), cabbage waste, Furadan 3G, and fertilizers such as Urea, TSP, KCl, and liquid cow manure. The tools employed were: polybags measuring 40 x 50 cm, small polybags, plastic pouches, hoes, machetes, watering cans, compasses, scales, and other necessary equipment.

The experiment followed a factorial completely randomized design (CRD) with two factors: earthworm soil and cabbage waste. The earthworm soil levels consisted of three treatments: 0, 20, and 30 grams per polybag. The cabbage waste levels were also three: 0, 420, and 630 grams per polybag. Each treatment was repeated three times, resulting in a total of 81 plants, with three plants per experimental unit. Data were analyzed using analysis of variance (ANOVA) with the F-test. If the F-value was greater than the F-table value, further testing was performed using Duncan's New Multiple Range Test (DNMRT) at a 5% significance level. All data analysis was conducted using SAS Windows version 9.0.

Finished land was sifted and entered. Place the seeds in 40 x 50 cm polybags. Cow manure, at a dose of 420 g per polybag, is incubated for seven days. Line the polybags with plastic bags to prevent earthworms from escaping. Introduce earthworms seven days after applying the manure by first loosening the soil in the polybags and digging to a depth of 15 cm below the surface. Land entered with evenly distributed in each polybag according to the dose treatment. Polybags that received worm manure were returned to use the soil in the polybag. Waste cabbage was given one day after giving worm land with the method: surface land dug first to a depth of 15 cm, then waste cabbage was put in and buried back.

Eggplant planting was carried out when the seedlings were one month old and had developed two true leaves. The planting method involved making holes in the planting medium according to the size of the seedling polybag, with one plant per polybag. Maintenance activities included watering, weeding, replanting if necessary, fertilization, and pest and disease control.

Harvesting involved picking eggplants that met the harvesting criteria. The fruit was considered ready for harvest when the skin color was bright purple and shiny. Harvesting was performed up to three times.

Observations were made on the following parameters: plant height (cm), flowering age (days after planting, DAP), age at first harvest (DAP), fruit diameter (cm), fruit weight (kg), and fruit length (cm).

2.1 Flowchart implementation

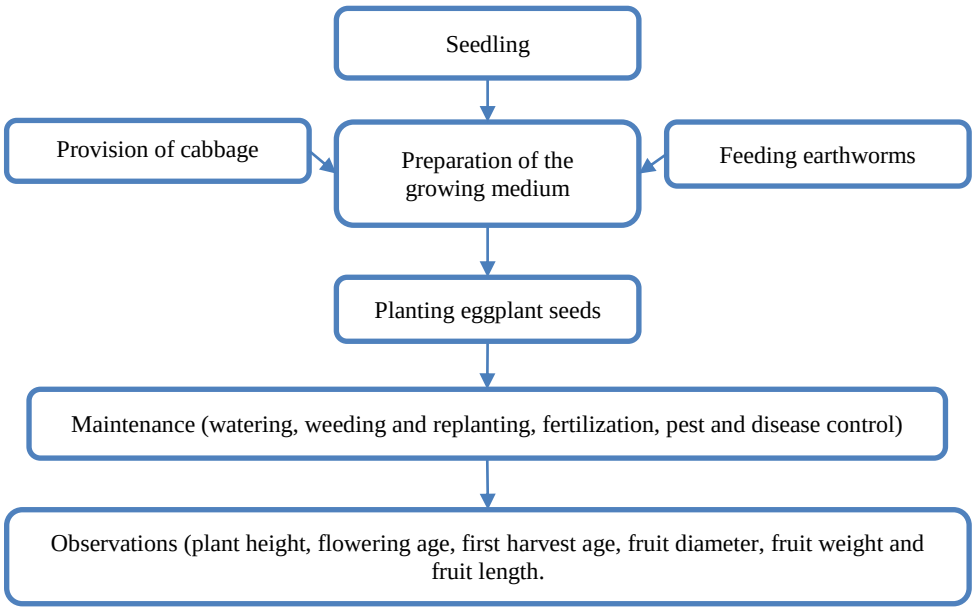

Figure 1. Research flow diagram

3. Results and Discussion

3.1. Influence of Interaction Giving Earthworms and Waste Cabbage on Crop Yields of Purple

Table 1 shows that the interaction between the administration of several levels of earthworms and cabbage waste on all observation parameters has not shown a significant interaction effect. This is suspected because the treatment range given was too narrow, so that the plant response was relatively similar. This is evident from the increase in plant growth with each increase in the administration of earthworms and cabbage waste. The tendency of administering a combination of 30 earthworms with a dose of 630 g of cabbage waste increased the height of purple eggplant plants better, namely 55.43 cm, compared to administration without earthworms and without cabbage waste. Plant height increased by 24.48%. Likewise, flowering age, harvest age, fruit length, fruit diameter, and fruit weight increased by 6.41%, 6.33%, 44.27%, 10.84%, and 51.03%, respectively. The results of research by Permana *et al* . (2020) also showed that the administration of earthworms increased the height of sorghum plants to 160 cm, the number of leaves to 16 strands, and the dry weight of the crown to 17.50 g per plant. This increase resulted from improvements in the growing medium, including better physical, chemical, and biological properties of the soil. Nutrient availability also increased because soil microbiological activity was enhanced by the interaction between earthworms and cabbage waste. As soil macrofauna, earthworms play a crucial role in nutrient cycling and energy flow because these organisms carry out the process of decomposing organic matter and ultimately contribute to soil fertility. The results of research by Warawa and Waluwu (2024) showed that the provision of earthworms increased the availability of macronutrients, namely 20% N, 18% P, and 15% K. According to Dwiastuti (2012), in the burrows of worms, they break down litter and digest it, then mix it with the soil to form casts containing 40% humus. In addition, that waste cabbage is also feed for worm farms. Research results by Rosad *et al.* (2016) show that giving waste vegetable cabbage (*Brassica oleraceae*) affects the growth weight and length of the worm soil (*Lumbricus rubella*) in succession from 0.50-1.02 g and 4.56-8.35 cm for 5 days of observation.

Table 1. Interactions giving earthworms and waste cabbage to eggplant plants

Interaction worm Soil (tail) x waste cabbage (g)	Plant height (cm)	Age flowering (HST)	Age harvest (HST)	Fruit length (cm)	Fruit diameter (cm)	Weight fruit (g)
0 x 0	44.53 ± 1.28	36.33 ± 0.58	58.00 ± 0.82	12.83 ± 0.41	33.04 ± 0.72	212.59 ± 9.84
20 x 0	45.96 ± 1.14	35.33 ± 0.58	56.66 ± 0.58	15.45 ± 0.55	33.62 ± 0.61	233.55 ± 11.27
30 x 0	47.00 ± 1.06	35.00 ± 1.00	56.33 ± 0.58	15.79 ± 0.63	33.94 ± 0.68	246.21 ± 12.18
0 x 420	45.50 ± 1.09	36.00 ± 0.00	58.00 ± 1.00	13.47 ± 0.47	33.67 ± 0.56	214.17 ± 10.46
20 x 420	52.26 ± 1.47	36.00 ± 0.58	56.00 ± 0.58	16.43 ± 0.66	34.36 ± 0.73	248.70 ± 13.64
30 x 420	53.96 ± 1.55	34.33 ± 0.58	54.66 ± 0.58	18.34 ± 0.71	35.68 ± 0.81	266.82 ± 14.95
0 x 630	45.83 ± 1.18	35.00 ± 0.58	57.66 ± 0.58	15.05 ± 0.52	34.05 ± 0.64	215.46 ± 9.73
20 x 630	50.96 ± 1.36	34.33 ± 0.58	55.33 ± 0.58	17.71 ± 0.68	35.16 ± 0.76	253.26 ± 13.18
30 x 630	55.43 ± 1.62	34.00 ± 0.00	54.33 ± 0.58	18.51 ± 0.73	36.62 ± 0.83	321.08 ± 16.72

3.2. Influence of Giving Earthworms on Crop Yields Eggplant Purple

Table 2 shows that the application of earthworms significantly increases the growth and yield of purple eggplant plants. The addition of 30 earthworm tails significantly increased plant height, fruit length, fruit diameter, and fruit weight per plant, respectively, by 15%, 27%, 5%, and 15% compared to plants without earthworm application. This suggests that earthworms play an important role in enhancing soil fertility—physically, chemically, and biologically. Earthworms can improve soil structure, increasing nutrient availability and simplifying nutrient uptake by plant roots. Additionally, earthworm bioturbation increases soil porosity and water retention. Lestari et al. (2025) stated that earthworm population density contributes to increased soil porosity; 47 earthworm tails increased soil porosity by 5% compared to 39 tails.

Table 2 also indicates that the addition of earthworms accelerates flowering and harvesting times. This is believed to enhance nutrient absorption by plant roots, facilitating the transition from the vegetative to the generative phase. Moreover, earthworm casts are rich in macronutrients such as nitrogen (N), phosphorus (P), and potassium (K), which are vital for supporting plant growth and yield. Simanjuntak et al. (2026) found that vermicompost produced using earthworms increased N, P, and K content by 0.47%, 1.20%, and 1.49%, respectively.

3.3. Influence of Giving Waste Cabbage on Crop Yields of Purple

Table 3 shows that the addition of cabbage waste significantly increases the growth and yield of purple eggplant plants. Applying 630 g of cabbage waste resulted in increases in plant height, fruit length, fruit diameter, and fruit weight, respectively, by 10%, 16%, 5%, and 14%. Conversely, research by Nazari et al. (2023) indicated that the application of banana peel POC increased fruit weight

per plant by 27%. It is believed that cabbage waste is rich in organic and macronutrients, which are very useful for supporting the growth and development of plant reproductive organs. However, the waste has not yet decomposed completely. According to Damayanti et al. (2017), the organic carbon content in vegetable waste reached 31.2%, while total nitrogen was 2.57%.

Table 2. Provision of earthworms on eggplant purple plant results

Worm land tail/polybag	Tall plant (cm)	Age interest (HST)	Age harvest (HST)	Fruit length (cm)	Fruit diameter (cm)	Weight fruit per plant (g)
0	45.28 ± 1.21 b	35.77 ± 0.58 c	57.88 ± 0.83 c	13.78 ± 0.48 a	33.59 ± 0.61 c	214.25 ± 10.36 b
20	49.73 ± 1.38 a	35.22 ± 0.52 b	56.00 ± 0.61 b	16.53 ± 0.57 a	34.38 ± 0.67 ab	245.17 ± 11.82 ab
30	52.13 ± 1.46 a	34.44 ± 0.49 a	55.11 ± 0.58 a	17.54 ± 0.63 a	35.41 ± 0.74 a	278.04 ± 13.57 a

Description: Numbers followed by letters; the same small letters in the same column indicate no real difference according to Duncan's New Multiple Range Test (DNMRT) at the 5% level.

Table 3. Provision of Waste Cabbage on Crop Yields of Purple Eggplant

Waste cabbage (g/polybag)	Plant height (cm)	Age interest (HST)	Age harvest (HST)	Fruit length (cm)	Fruit diameter (cm)	Weight fruit (g)
0	45.83 ± 1.17 b	35.55 ± 0.58 b	57.00 ± 0.82 b	14.69 ± 0.46 c	33.53 ± 0.58 b	230.78 ± 10.84 a
420	50.57 ± 1.34 a	35.44 ± 0.52 b	56.22 ± 0.63 a	16.08 ± 0.59 b	34.57 ± 0.67 ab	243.41 ± 11.95 a
630	50.74 ± 1.42 a	34.44 ± 0.49 a	55.77 ± 0.57 a	17.09 ± 0.64 a	35.28 ± 0.72 a	263.26 ± 13.68 a

Description: Numbers followed by lettersa are the same small in the same column; different No real according to Duncan's New Multiple Range Test (DNMRT) at the 5% level.

Figure 2. Research documentations

Table 3 also shows that applying 630 g of cabbage waste sped up flowering and reduced harvest age in purple eggplant compared with not applying cabbage waste. Cabbage waste contains significant amounts of nitrogen, potassium, and calcium, which play a role in chlorophyll formation and cell division. Jalaluddin *et al.* (2016) also stated that vegetable waste is rich in vitamins and minerals such as calcium (Ca), magnesium (Mg), and zinc (Zn).

4. Conclusion

Research results indicate that there is no interaction between earthworms and cabbage waste on all observed parameters. The application of 30 earthworms significantly increased the yield and production of purple eggplant. Similarly, the addition of 630 g of cabbage waste also significantly enhanced the yield and production of purple eggplant. The combination of 30 earthworms with 630 g of cabbage waste tended to produce better yield and production of purple eggplant. Based on these findings, it is recommended to use a combination of 30 earthworms and 630 g of cabbage waste. Further research should explore a broader range of treatments, as no clear interaction has yet been identified between earthworm application and cabbage waste.

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