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The Effect of Growing Media Composition and Eco-Enzyme Concentration on the Growth and Yield of Tomato *(Lycopersicon esculentum)*

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Abstract

Growth and production of tomato (*Lycopersicon esculentum*) are influenced by the quality of the planting medium and nutrient availability. This study aimed to determine the effects of planting medium and eco-enzyme concentration on the growth and yield of tomato plants. A two-factor Randomized Block Design was used, with factors including planting medium (soil; soil and rice husk charcoal 1:1; soil and cow manure 1:1; soil, rice husk charcoal, and cow manure 1:1:1) and eco-enzyme concentration (0, 1, 2, and 3 ml/L). The results showed a significant interaction between planting medium and eco-enzyme concentration on plant height from 28 to 63 days after planting, number of fruits per plant, and fruit weight per plant. The best treatment was the combination of soil and cow manure (1:1) with 3 ml/L eco-enzyme. The planting medium significantly affected plant height at 14 to 21 days after planting, the number of leaves from 14 to 42 days after planting, and flowering age, while the eco-enzyme concentration significantly affected plant height at 14 to 21 days and the number of leaves from 14 to 35 days after planting. The combination of organic growing media with eco-enzymes can enhance tomato growth and yield, particularly in terms of plant height, fruit number, and fruit weight per plant. These results suggest this treatment is optimal for increasing tomato growth and production by improving soil physical, chemical, and biological characteristics.

Keywords: Fertile Land, Organic Materials, Productivity, Sustainable Agriculture, Vigor

1. Introduction

Tomatoes (*Lycopersicon esculentum*) are a horticultural commodity with high economic and nutritional value. They are consumed both fresh and as raw materials in the food industry, driving increasing market demand. Consequently, efforts to enhance tomato productivity are essential to support food security and promote sustainable agricultural development (Cahya et al., 2025).

A crucial factor influencing tomato productivity is the growing medium. The growing medium provides mechanical support and supplies water, air, and nutrients to the plant. (Gulo et al., 2025). Selecting the appropriate growing medium is essential for optimal tomato growth. Tomato plants are sensitive to excess water, as their roots can easily suffer from hypoxia when waterlogged (Avivi et al., 2022). Therefore, the composition of the growing medium is a key factor in supporting tomato plant growth and yield.

, and manure are widely used in polybag cultivation. These organic materials can improve the physical structure of the growing medium, increase porosity and water retention, and provide essential nutrients for plants. Wales et al (2023) conducted research on the composition of soil and cow manure at a 1:1 ratio. The tomato plant height at 60 days after planting was 123.87 cm. The number of leaves on the tomato plant at 60 days after planting is 367.43. The number of fruits per plant is 35.37. The weight of the fruit per plant is 1,590.93 grams. In addition, the presence of organic matter supports the activity of microorganisms, which play a significant role in the decomposition process and nutrient availability (Sugianto & Jayanti, 2021). It can increase the potential production of the tomato plant by adding additional nutrients

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The addition of additional nutrients in tomato cultivation also plays an important role. One alternative that is increasingly being developed is eco-enzyme, a liquid produced by fermenting household organic waste such as fruit and vegetable waste and molasses. Eco-enzyme contains enzymes, growth hormones, vitamins, and microorganisms that function to accelerate the decomposition process of organic matter, increase the availability of nutrients, and stimulate plant growth naturally. Several studies report that the application of eco-enzymes to horticultural crops can increase vegetative growth, accelerate flowering, and improve harvest quality(Saraswati & Witoyo, 2024). The results of the study (Novianto, 2022) showed that using eco-enzyme had a significant effect at a concentration of 1.75 ml /L on the observed variables of growth and yield of shallot plants. The height of the shallot plant was 4.5 cm. The number of leaves on the shallot plant was 1.7.25 strands. The total weight of the bulb per plant was 19.39 grams. The weight of the bulb per seed was 3.75 grams. The number of bulb seeds per plant was 8, and the root length was 7.25 cm. However, its effectiveness was greatly influenced by the concentration used. A concentration that is too low does not cause a significant effect, whereas a concentration that is too high can cause physiological stress in plants (Irsyad et al., 2025). Therefore, adding an ecoenzyme that provides nutrient-rich organic planting media will increase the potential production of tomato plants.

Based on the description, this study aims to examine the effects of combining planting media with varying concentrations of eco-enzyme on the growth and yield of tomato plants (Lycopersicon esculentum). The study focuses on parameters such as plant height, leaf number, age at flower emergence, total number of fruits, and total fruit weight as indicators of successful cultivation.

2. Material and Methods

2.1. Place and Time

This research was conducted in Ciujung Baru Land, Kragilan Village, Serang Regency, Banten Province, at a degree coordinates (6.15° S; 106.29° E), elevation of approximately ±5 meters above sea level, with a temperature of 23–31°C, humidity of 75–85%, and rainfall of 200–300 mm/year. The study lasted for 4 months, namely January–April 2024.

2.2. Tools and materials

The tools used include 40 × 40 cm polybags, seedling *trays*, paranet, *sprayers*, watering cans, knives, measuring cups, buckets, bamboo stakes, labels, plastic, rulers, meters, and calipers. The research materials consist of tomato seeds of the Servo variety, NPK 15:15:15 fertilizer, TrueEco brand eco-enzyme, rice husk charcoal, cow manure, water, soil, and botanical/chemical pesticides. The following is a procedure diagram for Work.

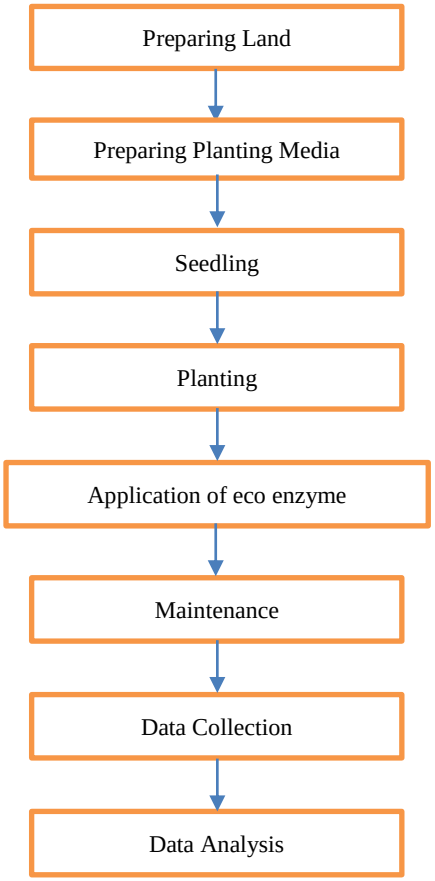

Figure 1. Flowchart implementation study

2.3. Research Design

This study used a Completely Randomized Design (CRD) with two factors. The first factor was the composition of the planting medium consisting of soil as a control, a mixture of soil and rice husk charcoal with a ratio of 1:1 (v/v), a mixture of soil and cow manure with a ratio of 1:1 (v/v), and a mixture of soil, rice husk charcoal, and cow manure with a ratio of 1:1:1 (v/v/v). The second factor was the concentration of the eco-enzyme, with 0 ml/L as the control and 1, 2, and 3 ml/L. Each treatment combination was repeated three times, and each experimental unit consisted of three plants. Observed parameters are as follows :

2.3.1. Plant Height (cm)

Tomato plant height is measured from the soil surface to the growing point. Measurements can be made with a ruler or a tape measure, depending on the plant's height. Plant height measurements begin 14 days after transplanting and continue at 7-day intervals until 56 days after transplanting.

2.3.2. Amount Leaf (strand)

Leaf counts were measured by manually counting the number of fully opened leaves per plant. Leaf counts began at 14 days after transplanting (DAP) and continued until 56 DAP, with 7-day intervals.

2.3.3. Flowering Age (DAP)

Observations of the day the flowers appear are made by calculating the number of days until the plant flowers, starting from the day after transplanting until the first flower appears.

2.3.4. Amount Total Fruit Per Plant (fruit)

Observations were conducted by calculating the total harvest and the number of fruits per plant, which were determined by counting the fruits on each sample plant across the first to fifth harvest periods. Harvesting was carried out every 2-3 days.

2.3.5. Weight Total Fruit Per Plant (grams)

The fresh weight of fruit per plant is calculated by adding all fruit harvested across all periods for each plant, then measuring it with a scale.

2.4. Data analysis

Observational data were analyzed using analysis of variance (ANOVA). If a significant or highly significant effect was found, an Honestly Significant Difference (HSD) test was performed at the 5% level to determine differences between treatments. Analysis done using IBM Statistics 25.

3. Results and Discussion

3.1. Plant Height

The average value of tomato plant height in the combination of planting media treatment with Eco Enzyme concentration is presented in Tables 1 and 2. The average tomato plant height for the single treatment is presented in Table 3.

Table 1. Average Plant Height (cm) of Tomatoes Due to Combination Treatment of Different Planting Media and Eco Enzyme Concentration (ml/L) at 28-42 DAP

Age	Planting Media Treatment	Plant Height (cm)							
		Eco Enzyme Concentration (ml/L)							
		0		1		2		3	
28 DAP	T	44.39 ±0.96	a	49.06 ±1.44	ab	49.58 ±0.56	ab	50.12 ±0.93	b
	T : AS 1:1	46.99 ±0.98	Ab	52,67±1,13	bc	54,01±0,01	bc	55,71±0,66	c
	T : PKS 1:1	50,43±1,83	b	55,01±0,01	bc	57,83±1,15	c	65,98±1,49	d
	T : AS : PKS 1:1:1	50,88±	bc	52,43±	bc	55,83±	c	58,24±	c
	BNJ 5%	5,23							
35 DAP	T	59,66±1,00	a	62,28±0,56	ab	62,46±0,93	ab	62,72±0,99	ab
	T : AS 1:1	61,72±1,47	ab	65,30±1,11	bc	66,61±0,01	bc	68,38±0,65	bc
	T : PKS 1:1	63,03±1,83	ab	67,64±0,01	bc	70,47±1,83	c	78,64±0,02	d
	T : AS : PKS 1:1:1	63,51±1,18	ab	65,10±1,51	b	68,50±0,66	bc	70,91±1,51	c
	BNJ 5%	5,28							
42 DAP	T	78,29±1,56	a	79,88±0,55	ab	80,36±1,02	ab	80,69±0,63	ab
	T : AS 1:1	79,42±1,17	ab	82,47±0,96	ab	85,01±0,24	b	85,14±0,28	b
	T : PKS 1:1	82,13±1,85	ab	85,24±0,47	b	89,63±1,63	b	97,31±0,79	c
	T : AS : PKS 1:1:1	80,31±1,01	ab	81,97±1,48	ab	85,47±0,95	b	89.71 ±2.34	B
	BNJ 5%	5.66							

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

Table 1 shows that the combination of growing media treatment and eco-enzyme concentration had a highly significant effect on tomato plant height between 28 and 42 days after planting. The tallest average plant height at 28 days was 65.98 cm (Land: Fertilizer Pen Cow 1:1 + 3 ml/l Eco Enzyme), while the shortest was 44.39 cm (Soil + 0 ml/l Eco Enzyme). At 35 days after planting (DAP 35), the tallest average tomato plant reached 78.64 cm (Land: Fertilizer Pen Cow 1:1 + 3 ml/l Eco Enzyme), whereas the shortest was 59.66 cm (Land + 0 ml/l Eco Enzyme). At 42 days after planting, the tallest average plant height was 97.31 cm (Soil: Cow Manure 1:1 + 3 ml/l Eco Enzyme), and the shortest was 78.29 cm (Soil + 0 ml/l Eco Enzyme).

Table 2 shows that the combination of planting media treatment and Eco Enzyme fertilizer concentration had a very significant effect on tomato plant height at 49–63 DAP. The average height of the highest tomato plants at the age of 49 DAP was 107.98 cm (Soil: Cow Manure 1:1 + 3 ml/L Eco Enzyme), while the lowest was 88.36 cm (Soil + 0 ml/L Eco Enzyme). At the age of 56 DAP, the highest plant height reached 115.21 cm (Soil: Cow Manure 1:1 + 3 ml/L Eco Enzyme), while the lowest was 95.66 cm (Soil + 0 ml/L Eco Enzyme). Meanwhile, at the age of 63 DAP, the highest plant height was still obtained in the treatment of Soil: Cow Manure 1:1 + 3 ml/L Eco Enzyme, with a value of 115.33 cm, and the lowest in the treatment of soil + 0 ml/L Eco Enzyme, namely 95.76 cm.

Table 3 shows that the single treatment of planting media and eco-enzyme concentration had a significant effect on tomato plant height at 14 and 21 DAP, but not at 7 DAP. At the age of 21 DAP, the Soil: Cow Manure (1:1) planting media gave the highest plant height (44.34 cm),

while the lowest plant height (38.10 cm) was obtained in the soil planting media. The treatment concentration of 3 ml/L gave the highest plant height of 44.13 cm, and the lowest plant height of 38.53 cm was obtained at 0 ml/L Eco Enzyme.

Table 2. Average Plant Height (cm) of Tomatoes Due to Combination Treatment of Different Planting Media and Eco Enzyme Concentration (ml/L) at 49-63 DAP

Age	Planting Media Treatment	Plant Height (cm)							
		Eco Enzyme Concentration (ml/L)							
		0		1		2		3	
49 DAP	T	88.36 ±1.39	a	89.44 ±1.66	a	90.72 ±0.33	a	91.02 ±0.77	a
	T : AS 1:1	88.99 ±2.31	a	91.63 ±1.17	a	94.01 ±0.09	ab	95.44 ±0.46	ab
	T : PKS 1:1	93.23 ±1.91	a	94.84 ±0.96	ab	100.83 ±1.51	b	107.98 ±1.57	c
	T : AS : PKS 1:1:1	89.08 ±0.83	a	90.83 ±1.52	a	94.47 ±1.24	ab	100.58 ±3.24	b
	BNJ 5%	7.12							
56 DAP	T	95.66 ±1.39	a	96.71 ±1.63	a	97.96 ±0.33	a	98.26 ±0.75	a
	T : AS 1:1	96.29 ±2.31	a	98.93 ±1.17	a	101.28 ±0.11	ab	102.71 ±0.49	ab
	T : PKS 1:1	100.53 ±1.90	a	102,14±0,96	ab	108,07±1,48	b	115,21±1,60	c
	T : AS : PKS 1:1:1	96,34±0,80	a	98,07±1,55	a	101,77±1,24	ab	107,81±3,26	b
	BNJ 5%	7,13							
63 DAP	T	95,76±1,38	a	98,38±0,74	ab	98,52±1,41	ab	98,52±0,23	ab
	T : AS 1:1	96,33±2,32	ab	102,82±0,52	ab	103,22±1,15	b	103,32±0,89	b
	T : PKS 1:1	100,58±1,92	ab	102,28±0,94	ab	108,14±1,48	b	115,33±1,57	c
	T : AS : PKS 1:1:1	96,43±0,84	ab	98.18 ±1.56	ab	103.41 ±1.09	b	107.90 ±3.29	b
	BNJ 5%	7.11							

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

Table 3. Average Plant Height (cm) Due to Different Planting Media Treatments and Eco Enzyme Concentrations (ml/L) at 7-21 DAP

Treatment	Plant Height (cm)				
	7 DAP	14 DAP		21 DAP	
Growing media					
T	21.08 ±0.20	24.97 ±0.33	a	38.1 0 ±0.43	a
T : AS 1:1	21.26 ±1.42	27.18 ±0.86	ab	40.33 ±1.28	b
T : PKS 1:1	22.5 0 ±0.52	28.79 ±0.65	b	44.34 ±1.41	c
T : AS : PKS 1:1:1	21.81 ±0.19	27.84 ±1.31	B	42.94 ±1.82	c
BNJ 5%	tn.	2.44		1.56	
Eco Enzyme Conc.					
0 ml/L	20.64 ±0.72	25.61 ±0.62	a	38.53 ±0.92	a
1ml/L	20.83 ±0.59	26.41 ±0.79	a	40.43 ±1.28	a
2 ml/L	22.14 ±0.40	27.83 ±0.75	ab	42.62 ±1.57	b
3 ml/L	23.04 ±0.69	28.93 ±1.36	b	44.13 ±1.97	b
BNJ 5%	tn.	2.44		1.56	

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; tn = no significant difference; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

The results showed that neither the growing media treatment nor the eco-enzyme concentration at 7–14 days after planting (DAP) had a significant effect on plant height. This condition is related to the initial adaptation phase, when plant growth still relies on energy reserves from the seeds, so nutrient uptake from the media or additional treatments has not had a significant effect. Root growth in the initial stage is also not yet fully developed to absorb nutrients from the media, so the response to the treatments is unclear (Yavitt et al., 2021).

The treatment effects on planting media and eco-enzyme concentration at 21 DAP began to significantly affect plant height. The planting media Soil: Cow Manure (1:1) produced the highest plant height among treatments, and the eco-enzyme concentration of 3 ml/L showed the best results, although not significantly different from 2 ml/L. These results indicate that cow manure increases the organic matter content and improves the media's physical properties, such as porosity and water-holding capacity, thereby stabilizing nutrient availability (Hasibuan, 2015).

The application of eco-enzymes at the appropriate concentration accelerates the decomposition of organic matter and increases the availability of essential nutrients by stimulating the activity of enzymes, microorganisms, and amino acids (Azuhro et al., 2024).

The growing medium serves as a place for plants to grow, provides mechanical support, and provides water and nutrients necessary for vegetative growth (Nainggolan & Ginting, 2023). Cow manure, as a component of the medium, improves soil quality by increasing the content of macro- and micro-nutrients and supporting soil microbial activity. Eco-enzymes function as natural stimulants, enriching the root environment with bioactive compounds, enzymes, and hormones (Wakano, 2024). The presence of protease, amylase, and lipase enzymes accelerates the breakdown of complex compounds into simpler, more easily absorbed forms, while chemical compounds such as acetic acid, nitrate, and carbonate improve nutrient availability in the growing medium (Riska & Anhar, 2022). These conditions generally support cell division, stem elongation, and increased plant height (Anas et al., 2020).

The treatment of growing media and eco-enzyme concentration at 28–56 days after planting showed a significant interaction with plant height. This interaction indicates that the effectiveness of eco-enzymes is significantly influenced by the growing media used in this study. The results are better than those reported by Wales et al. (2023), which used a 1:1 soil-to-cow manure ratio. The tomato plant height at 45 days after planting is 77.56 cm, whereas research shows that adding ecoenzymes produces taller plants at 107.98 cm.

Organically rich growing media can store and gradually release nutrients, while eco-enzymes increase nutrient absorption efficiency and stimulate plant metabolic activities such as photosynthesis and protein synthesis (Deningsih & Indra Swari, 2025). The combination of these two factors creates optimal conditions that neither treatment alone provides, resulting in better plant growth.

3.2. Number of Leaves

The average number of tomato leaves in the combination of planting media treatment with Eco Enzyme concentration is presented in Tables 4 and 5. Table 4 shows that the single planting media treatment had a significant effect on the number of tomato leaves at 14, 21, and 28 DAP, but had no significant effect at 7 DAP. At the age of 28 DAP, the Soil planting medium: Cow Manure (1:1) produced the highest number of leaves (14.31 pieces), and the soil planting media treatment produced the lowest results (12.08 pieces).

Table 4 shows that a single Eco Enzyme concentration treatment significantly affected the number of tomato plant leaves at 14, 21, and 28 days after planting, but had no significant effect at 7 days after planting. At 28 days after planting, a concentration of 3 ml/L produced the highest number of leaves (14.36). Moreover, the lowest yield was obtained in the 0 ml/L treatment with an average of 11.86 strands.

Table 4. Average Number of Leaves (Sheets) of Plants Due to Different Planting Media and Eco Enzyme Concentration Treatments (ml/L) at 7-28 DAP

Treatment	Number of Leaves (Sheets)						
	7 DAP	14 DAP		21 DAP		28 DAP	
Growing media							
T	1.67 ±0.14	5.42 ±0.37	a	6.89 ±0.33	a	12.08 ±0.51	a
T : AS 1:1	1.94 ±0.07	5.78 ±0.36	ab	7.36 ±0.24	a	13.03 ±0.36	b
T : PKS 1:1	2.47 ±0.35	6.56 ±0.26	b	8.50 ±0.57	b	14.31 ±0.74	c
T : AS : PKS 1:1:1	1,97±0,31	6,17±0,20	ab	8,64±0,35	b	14,03±0,60	c
BNJ 5%	tn	0,86		0,79		0,70	
Eco Enzyme Conc.							
0 ml/L	1,69±0,22	5,28±0,27	a	6,92±0,35	a	11,86±0,42	a
1ml/L	1.89 ±0.27	5.83 ±0.32	ab	7.67 ±0.45	ab	13.42 ±0.60	b
2 ml/L	2.28 ±0.31	6.17 ±0.33	b	8.28 ±0.42	b	13.81 ±0.46	bc
3 ml/L	2.36 ±0.20	6.64 ±0.09	b	8.53 ±0.58	b	14.36 ±0.65	c
BNJ 5%	Mr.	0.86		0.79		0.70	

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; tn = no significant difference; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

Table 5 shows that a single treatment of planting media significantly affected the number of tomato plant leaves at 35 and 42 DAP, but had no significant effect at 49, 56, and 63 DAP. At 4 2 DAP, the Soil: Cow Manure (1:1) planting media produced the highest number of leaves, 17.75 and 18.64 leaves, respectively, while the Soil media produced the lowest results, 15.56 and 17.08 leaves. At 49 to 63 DAP, all treatments showed no significant difference.

Table 5 shows that the single Eco Enzyme concentration treatment had a significant effect on the number of tomato plant leaves at 35 days after planting, but had no significant effect at 42, 49, 56, and 63 days after planting. At 35 days after planting, the 3 ml/L Eco Enzyme concentration treatment produced the highest number of leaves (17.39), significantly higher than the treatment without Eco Enzyme (0 ml/L), which produced the lowest

(16.17). At 42-63 days after planting, all treatments showed no significant differences in leaf number.

Table 5. Average Number of Leaves (Sheets) of Plants Due to Single Treatment of Differences in Planting Media and Eco Enzyme Concentration (ml/L) at 35-63 DAP

Treatment	Number of Leaves (Sheets)									
	35 DAP		42 DAP		49 DAP		56 DAP		63 DAP	
Growing media										
T	15,56±0,23	a	17,08±0,12	a	17,94±0,10		18,58±0,05		19,25±0,08	
T : AS 1:1	16,89±0,19	b	17,64±0,18	ab	18,00±0,25		18,50±0,29		19,28±0,11	
T : PKS 1:1	17,75±0,38	b	18,64±0,43	b	19,00±0,42		19,61±0,48		20,03±0,55	
T : AS : PKS 1:1:1	16,92±0,36	b	18,17±0,35	ab	18,64±0,40		19,31±0,44		19,89±0,43	
BNJ 5%	0,99		1,16		tn		tn		tn	
Eco Enzyme Conc.										
0 ml/L	16,17±0,44	a	17,42±0,30		18,03±0,21		18,53±0,19		19,17±0,17	
1ml/L	16,58±0,47	ab	17,64±0,31		18,14±0,38		18,72±0,42		19,50±0,36	
2 ml/L	16,97±0,42	ab	18,14±0,35		18,72±0,29		19,36±0,31		19,78±0,22	
3 ml/L	17,39±0,57	b	18,33±0,55		18,78±0,54		19,39±0,55		20.00 ±0.58	
BNJ 5%	0.99		tn		tn		tn		tn	

Description: Numbers followed by the same letter in the same combination and age show no significant difference in the 5% BNJ test; tn = not significantly different; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

A growing medium composed of soil and manure yields the best results because it provides sufficient nitrogen for leaf development. Nitrogen plays a key role in the formation of chlorophyll and essential proteins required by plants for photosynthesis, so the more nitrogen available, the greater the plant's ability to form leaves. Optimal photosynthesis under these conditions produces energy that supports the formation of vegetative organs, including leaves. Phosphorus also plays a role in supporting cell division and energy supply, thereby accelerating leaf tissue formation. The presence of manure in the medium also improves soil structure and increases microbial activity. Microbes play a significant role in the decomposition of organic matter by producing compounds that are readily absorbed by plants, thereby improving nutrient uptake efficiency and increasing leaf number (Wang et al., 2022). These conditions indicate that the combination of soil and manure has the potential to create a more fertile rooting environment, good aeration, and sufficient nutrient availability for optimal leaf growth.

These findings demonstrate that applying eco-enzymes at the appropriate concentration can create growing media conditions more conducive to plant growth. The enzymes, hormones, and micronutrients in eco-enzymes stimulate plant metabolism, particularly leaf cell division and enlargement, thereby directly increasing leaf number and supporting vegetative development. (Novianto, 2022). Increasing the number of leaves will expand the plant's photosynthetic surface area, thereby positively impacting productivity. Furthermore, the presence of microorganisms such as *Bacillus sp.* in eco-enzymes is thought to play a role in nitrogen fixation, thereby increasing leaf chlorophyll content and supporting the formation of new leaves (Verma et al., 2024). In line with the study by Novianto (2022), the addition of 1.75 ml/L of the ecoenzyme produces an average of 17.75 leaves, whereas 0 ml/L produces 15 leaves. This finding confirms that administering eco-enzymes significantly affects leaf growth, consistent with previous research on their effectiveness in horticultural plants.

3.3. Flowering Age

The average value of the flowering age of plants due to the treatment of planting media and Eco Enzyme concentration is presented in Table 6. Table 6 shows that a single treatment with growing media significantly affected plant flowering time. The soil treatment with rice husk charcoal resulted in the longest flowering time (29.83 days) and was not significantly different from the soil treatment with rice husk charcoal and cow manure. The soil with cow manure had the fastest flowering time (28.64 days) and was significantly different from the other treatments. Table 6 also shows that the single treatment with Eco Enzyme concentration did not significantly affect plant flowering time. This finding is consistent with research by Mustaman & Fatman (2017), which found that growing media with a higher proportion of manure resulted in the fastest flowering time in tomato plants. Cow manure, which is rich in macro- and micro-trients, such as nitrogen and phosphorus, plays an important role in accelerating plant growth, including flowering (Meliana et al., 2021).

Mature cow dung planting media can accelerate flower growth because it contains various nutrients, including phosphorus and potassium (Badaria & Aldin, 2024). Phosphorus in plants can also help with assimilation and respiration, as well as accelerate flowering, seed ripening, and fruit formation. (Putra & Maizar, 2023). Speeding up flowering also occurs due to potassium's role as a

metabolic activator and transporter of metabolic products, thus accelerating the flowering process (Fitriyah et al., 2024). This condition promotes healthier plant roots and accelerates the transition to the flowering phase.

Table 6. Average Flowering Age (Days) of Tomato Plants Due to Different Planting Media and Eco Enzyme Concentration Treatments (ml/L).

Treatment	Flowering Age (Days)	
Growing media		
T	29.83 ±0.24	a
T : AS 1:1	29.47 ±0.22	a
T : PKS 1:1	28.64 ±0.26	b
T : AS : PKS 1:1:1	29.39±0,16	a
BNJ 5%	0.61	
Eco Enzyme Concentration		
0 ml/L	29.61 ±0.17	
1ml/L	29.53 ±0.39	
2 ml/L	29.22 ±0.41	
3 ml/L	28.97 ±0.10	
BNJ 5%	tn.	

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; tn = no significant difference; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

3.4. Number of Fruits Per Plant

The average value of the total number of fruits per tomato plant due to the combination of planting media treatment and Eco Enzyme concentration is presented in Table 7.

Table 7 shows a significant interaction between treatments on the total number of tomato fruits. The treatment with a combination of planting media (Soil: Cow Manure 1:1 + 3 ml/L Eco Enzyme) produced the highest average number of fruits (47.44), which was significantly higher than all other treatments. The treatment with a combination of planting media (Soil + 0 ml/L Eco Enzyme) produced the lowest average number of fruits, 24.56.

The increase in the total number of fruits per plant in this treatment can be explained by the dual role of the growing medium and Eco Enzyme. The growing medium, made from cow manure, provides macronutrients such as potassium and phosphorus, which are involved in fruit formation, development, and ripening. (Hafizah & Mukarramah, 2017). Potassium helps distribute the results of photosynthesis to the fruit, while phosphorus supports energy metabolism for the formation of seeds and fruit tissue. (Sari et al., 2022).

Table 7. Average Total Number of Fruits per Tomato Plant (Fruit) Due to Combination Treatment of Different Planting Media and Eco Enzyme Concentration (ml/L)

Planting Media Treatment	Total Number of Fruits (Fruits)							
	Eco Enzyme Concentration (ml/L)							
	0		1		2		3	
T	24.56 ±1.17	a	26.11 ±1.75	ab	28.67 ±0.84	ab	31.78 ±0.33	b
T : AS 1:1	25.44 ±2.73	a	33.56 ±2.06	b	38.78 ±0.59	c	39.44 ±2.21	c
T : PKS 1:1	33.56 ±1.35	b	35.22±1,39	bc	40.33 ±0.51	c	47.44 ±0.11	d
T : AS : PKS 1:1:1	31.89 ±1.12	b	36.33 ±0.67	bc	39.89 ±1.75	c	40.00 ±0.62	c
BNJ 5%	5.18							

Description: Numbers followed by the same letter at the same treatment and age show no significant difference in the 5% BNJ test; tn = no significant effect; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

In the research, this produced the highest average amount of fruit, especially 47.44 pieces, and the lowest, with the study by Wales et al. (2023), which produced an average of 35.37 pieces, with the addition of Ecoenzyme. Ecoenzyme contains active enzymes, growth hormones such as auxin and gibberellin, and microorganisms that improve nutrient availability in the root zone (Siregar et al., 2024). These hormones play a role in coordinating the fruit-formation process. Auxin plays a role as a signal for the initial trigger of fruit formation and the formation of the locular network, whereas gibberellin stimulates growth and enlargement of the fruit through stimulation of cell expansion. Both of them show a mechanism in which they complement each other, where auxin initiates the formation of fruit. At the same time, gibberellin promotes sustainable growth until stage enlargement (Mignolli et al., 2023). The synergy between nutrient-rich growing media and Eco Enzyme application creates optimal physiological and nutritional conditions, resulting in a higher total number of fruits per plant compared to other treatments.

3.5. Fruit weight per plant

The average value of the total weight of tomato fruit due to the combination of planting media treatment and Eco Enzyme concentration is presented in Table 8.

Table 8 shows a significant interaction between treatments on the total weight of tomato fruit. Treatment with a combination of planting media (Soil: Cow Manure 1:1 + 3 ml/L Eco Enzyme) produced the highest average fruit weight (1713.17 grams) and was significantly different from other treatments. Meanwhile, treatment with a combination of planting media (Soil + 0 ml/L Eco Enzyme) produced the lowest average fruit weight at 862.82 grams.

Table 8. Average Total Tomato Fruit Weight (grams) Due to Combination Treatment of Different Planting Media and Eco-Enzyme Concentration (ml/L)

Plant Media Treatment	Fruit Boot (g)							
	Eco Enzyme Concentration (ml/L)							
	0		1		2		3	
T	862.82 ±65.82	a	924,644 ±70.28	ab	952.82 ±27.41	ab	1103.63 ±17.51	ab
T: AS 1:1	889.01 ±69.69	a	1088.99 ±37.15	ab	1222.43 ±16.22	b	1349.93 ±87.16	b
T : PKS 1:1	1157.16 ±41.27	b	1248.48 ±75.49	b	1395.13 ±18.75	b	1713,17 ±45,21	c
T : AS : PKS 1:1:1	1071.19 ±59.16	ab	1237.44 ±17.57	b	1356.53 ±55.75	b	1357.14 ±63.82	b
BNJ 5%	262,17							

Description: Numbers followed by the same letter in the same treatment and age show no significant difference in the 5% BNJ test; tn = no significant effect; T = Soil; AS = Rice Husk Charcoal; PKS = Cow Manure.

This condition confirms that the combination of planting media and appropriate Eco Enzyme concentration can significantly increase plant productivity. This finding aligns with reports by Assadiyah et al. (2023), which state that the interaction between the planting medium and liquid organic fertilizer can increase the yield of tomato plants, including overall fruit weight. The interaction between the planting medium and Eco Enzyme plays an important role in determining fruit weight per plant, as both support the reproductive phase through fruit filling. The cow manure planting medium provides phosphorus, potassium, calcium, and microelements that contribute to flower development, cell filling, and improving fruit quality (Sari et al., 2022). Potassium plays a role in the translocation of photosynthetic products, the division and enlargement of fruit cells, and increases sugar accumulation, which affects the final weight of the fruit (Yan et al., 2022). Phosphorus supports energy metabolism and seed formation, which indirectly increases the size and weight of the fruit (Lukman, 2010).

In the research, this produces the highest average heavy fruit, i.e., 1713 grams, whereas Wales et al. (2023) report an average of 1590.93 grams of fruit due to the addition of an enzyme. Eco Enzyme complements the role of growing media by providing active enzymes, natural hormones, and functional microorganisms. The auxins and gibberellins in it play a role in cell division and elongation, accelerate fruit formation, and reduce flower loss (Dermawan et al., 2020). Fermented microorganisms increase nutrient availability, improve soil quality, and produce metabolites that support the plant's generative phase (Afa et al., 2025). This combination of factors creates optimal physiological conditions, thereby significantly increasing total fruit weight per plant.

4. Conclusion

The combination of soil and cow manure (1:1) as planting media, supplemented with 3 ml/L Eco Enzyme, produced the best results in tomato plants. This result was evidenced by the greatest plant height between 28 and 63 days after planting (DAP), the highest number of fruits per plant, and the greatest fruit weight per plant. The planting media treatment alone significantly influenced plant height at 14 and 21 DAP, the number of leaves from 14 to 42 DAP, and accelerated the onset of flowering. Meanwhile, the Eco Enzyme concentration treatment significantly affected plant height at 14 to 21 DAP and the number of leaves from 14 to 35 DAP. This combination treatment consistently promoted positive effects during both the vegetative and generative phases. Based on these results, it is recommended that farmers use a planting medium composed of soil and cow manure (1:1) with the addition of 3 ml/L Eco Enzyme to optimize tomato growth and yield.

References

Afa, M., Junaedi, & Irwansyah. (2025). *Pupuk organik cair (POC) berbahan mikroorganisme lokal (MOL)*.

Anas, M., Liao, F., Verma, K. K., Sarwar, M. A., Mahmood, A., Chen, Z. L., Li, Q., Zeng, X. P., Liu, Y., & Li, Y. R. (2020). Fate of nitrogen in agriculture and environment: Agronomic, eco-physiological and molecular approaches to improve nitrogen use efficiency. *Biological Research, 53*(1). https://doi.org/10.1186/s40659-020-00312-4

Assadiyah, A. N., Dewanti, F. D., & Sulistyono, A. (2023). Respon hasil tanaman tomat (*Solanum lycopersicum* L.) terhadap macam media tanam dan konsentrasi pupuk organik cair limbah kulit buah. *Agro Bali: Agricultural Journal, 6*(1), 93–104. https://doi.org/10.37637/ab.v6i1.1079

Avivi, S., Mufidah, A. I., Siswoyo, T. A., & Restanto, D. P. (2022). Pengaruh cekaman genangan terhadap pertumbuhan dan hasil beberapa varietas tomat (*Lycopersicum esculentum* Mill.). *Agrovigor: Jurnal Agroekoteknologi, 15*(1), 1-5. https://doi.org/10.21107/agrovigor.v15i1.8866

Azuhro, V., Dzakiy, M. A., & Minarti, I. B. (2024). Effectiveness of eco enzyme for inducing flower growth in *Dendrobium Sonia-ersakul* orchids. *Jurnal Pijar MIPA, 19*(1), 179–184. https://doi.org/10.29303/jpm.v19i1.6217

Badaria, & Aldin. (2024). Respon pertumbuhan dan produksi tanaman terong terhadap media tanam dan pupuk kandang sapi (*Solanum melongena* L.). *Jurnal Agroteknologi Unidayan, 10*(2), 34–42.

Cahya, H. N., Surya, M. F., Purawijaya, R. R., & Anugrah, D. F. (2025). Sosialisasi dan pendampingan penanaman bibit tanaman sebagai strategi ketahanan pangan berkelanjutan. *Apanda Journal of Community Service, 4*(1). https://doi.org/10.56916/pjcs.v4i1.2385

Deningsih, S., & Swari, E. I. (2025). Respon tanaman tomat terhadap pemberian berbagai konsentrasi eco-enzyme diperkaya kecambah kacang hijau dan air cucian beras. *Jurnal Agroecotenia, 8*(1).

Dermawan, R., Saleh, I. R., Mantja, K., Iswoyo, H., & Salmiati, S. (2020). Pengendalian kejadian gugur bunga dan buah dengan aplikasi IAA, IBA, dan giberelin pada tanaman cabai (*Capsicum annuum* L.). *Agrosainstek: Jurnal Ilmu dan Teknologi Pertanian, 4*(1), 35–40. https://doi.org/10.33019/agrosainstek.v4i1.56

Fitriyah, N., Rahmatika, W., & Contesya, S. M. (2024). Kombinasi pupuk kandang kambing dan kalium nitrat terhadap pertumbuhan dan kecepatan berbunga jagung manis (*Zea mays* var. *saccharata*). *VIABEL: Jurnal Ilmiah Ilmu-Ilmu Pertanian, 18*(1), 40–48. https://doi.org/10.35457/viabel.v18i1.3407

Gulo, L. S., Telaumbanua, E., Bate'e, G. F., Waruwu, P. C. D., Harefa, N. R. J., & Larosa, Y. M. (2025). Pertumbuhan kacang tanah di media tanam yang berbeda (tanah, kompos, dan pasir). *PENARIK: Jurnal Ilmu Pertanian dan Perikanan, 2*(2), 98–103.

Hafizah, N., & Mukarramah, R. (2017). Aplikasi pupuk kandang kotoran sapi pada pertumbuhan dan hasil tanaman cabai rawit (*Capsicum frutescens* L.) di lahan rawa lebak. *ZIRAA'AH, 42*(1), 1–7.

Hasibuan, A. S. Z. (2015). Pemanfaatan bahan organik dalam perbaikan beberapa sifat tanah pasir pantai selatan Kulon Progo. *Planta Tropika: Journal of Agro Science, 3*(1). https://doi.org/10.18196/pt.2015.037.31-40

Irsyad, H., Ibnusina, F., & Silfia. (2025). Pemanfaatan kulit pisang kepok sebagai ekoenzim untuk pertumbuhan dan produksi selada (*Lactuca sativa* L.) di lahan organosol. *Agrivet: Jurnal Ilmu-Ilmu Pertanian dan Peternakan, 13*(1). https://doi.org/10.31949/agrivet.v13i1.14248

Lukman, L. (2010). Efek pemberian fosfor terhadap pertumbuhan dan status hara pada bibit manggis. *Jurnal Hortikultura, 20*(1).

Meliana, M., Sulistyawati, & Pratiwi, S. H. (2021). The effect of fertilizing cow manure on growth and production of long bean plant (*Vigna sinensis* L.). *Jurnal Agroteknologi Merdeka Pasuruan, 5*(2).

Mignolli, F., Mariotti, L., & Vidoz, M. L. (2023). Reduced gibberellin biosynthesis and response in fruits of the auxin insensitive diageotropica tomato mutant. *Plant Growth Regulation, 99*(3), 505–513. https://doi.org/10.1007/s10725-022-00921-x

Mustaman, & Fatman, M. (2017). Pengaruh pemberian berbagai jenis pupuk kandang dan media tanam terhadap pertumbuhan dan produksi tanaman mentimun (*Cucumis sativus* L.). *Agrovital, 2*(2).

Nainggolan, L. P., & Ginting, I. J. (2023). Sosialisasi media tanam yang baik bagi tanaman kepada warga Desa Perumnas Simalingkar. *AbdiParahita, 2*(1).

Novianto. (2022). Response of liquid organic fertilizer eco enzyme on growth and production of shallot (*Allium ascalonicum* L.). *Jurnal Agronomi Tanaman Tropika (JUATIKA), 4*(1), 147–154. https://doi.org/10.36378/juatika.v4i1.1782

Putra, M. R. S., & Maizar. (2023). Pengaruh POC eceng gondok dan pupuk fosfat alam terhadap pertumbuhan dan produksi kacang hijau (*Vigna radiata* L.). *Jurnal Agroteknologi Agribisnis dan Akuakultur, 3*(2).

Riska, & Anhar, A. (2022). The effect of eco enzyme application method on the growth of mustard plants (*Brassica juncea* L.). *Jurnal Serambi Biologi, 7*(3), 275–282.

Saraswati, A. R., & Witoyo, J. E. (2024). Eco enzyme sebagai solusi inovatif dalam pengelolaan pascapanen hortikultura: Tinjauan agribisnis dan teknologi. *Jurnal Ilmu-Ilmu Pertanian, 31*(2), 72–78. https://doi.org/10.55259/jiip.v31i1.35

Sari, G. L. M., Pertami, R. R. D., & Eliyatiningsih, E. (2022). Aplikasi pupuk kalium terhadap pertumbuhan dan produksi tanaman cabai merah besar (*Capsicum annuum* L.). *Agropross: National Conference Proceedings of Agriculture*, 221–233. https://doi.org/10.25047/agropross.2022.292

Siregar, B. L., Siallagan, R. S., Butar Butar, S., Mahmudi, B., & Pujiastuti, E. S. (2024). The nutrient content of eco-enzymes from mixture of various fruit peels. *Agro Bali: Agricultural Journal, 7*(2), 475–487. https://doi.org/10.37637/ab.v7i2.1646

Sugianto, S., & Jayanti, K. D. (2021). Pengaruh komposisi media tanam terhadap pertumbuhan dan hasil bawang merah. *Agrotechnology Research Journal, 5*(1), 38. https://doi.org/10.20961/agrotechresj.v5i1.44619

Verma, P., Chauhan, P., Kumar, N., & Mishra, A. (2024). The role of *Bacillus* spp. in solubilizing essential nutrients. *Journal of Materials Applied Science, 5*(2), 1012.

Wakano, F. (2024). Potensi eco-enzyme dalam meningkatkan pertumbuhan dan produksi tanaman. *Journal Gallus Gallus, 2*(3), 38–44. https://doi.org/10.51978/gallusgallus.v2i3.489

Wales, S., Tulung, S. M. T., & Mamarimbing, R. (2023). Pertumbuhan dan produksi tanaman tomat (*Solanum lycopersicum* L.) pada beberapa jenis media tanam. *Jurnal Agroekoteknologi Terapan, 4.*

Wang, G., Ren, Y., Bai, X., Su, Y., & Han, J. (2022). Contributions of beneficial microorganisms in soil remediation and quality improvement of medicinal plants. *Plants, 11*(23). https://doi.org/10.3390/plants11233200

Yan, Y., Lu, J., Song, K., Li, B., Yang, J., & Zhang, C. (2022). Effects of potassium fertilization on the quality of 'Muscat Hamburg' grapes. *Journal of Tianjin Agricultural University, 2*(9), 14–18.

Yavitt, J. B., Pipes, G. T., Olmos, E. C., Zhang, J., & Shapleigh, J. P. (2021). Soil organic matter, soil structure, and bacterial community structure in a post-agricultural landscape. *Frontiers in Earth Science, 9*. https://doi.org/10.3389/feart.2021.590103