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GROWTH AND RESULTS OF TOMATOES (*Solanum lycopersicum* L.) AT TRICHOCOMPOST DOSAGE AND ECO ENZYME CONCENTRATION

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ABSTRACT

Tomatoes are vegetables that are widely consumed by Indonesians. Increased demand for tomato plants requires an increase in production. This research aims to determine and study the effect of trichocompost dosage and eco enzyme concentration on the growth and production of tomato plants. This research was conducted at Exfarm, Faculty of Agriculture, Hasanuddin University, Makassar, South Sulawesi. The research was conducted in November 2023 - March 2024. This research was conducted using a 2-factor factorial design with a Randomized Group Design (RAK) as the environmental design. The first factor was the dose of trichocompost consisting of 3 levels, namely 0 t ha^{-1}, 10 t ha^{-1}, 20 t ha^{-1}, and the second factor was the concentration of eco enzymes consisting of 4 levels, namely 0 mL L^{-1}, 3 mL L^{-1}, 6 mL L^{-1}, 9 mL L^{-1}. The results showed that there was no significant interaction between trichocompost and eco enzyme treatments. The results showed that the treatment of trichocompost 20 t ha^{-1} and eco enzyme 6 mL L^{-1} can have a good effect on the growth and production of tomato plants.

Keywords: Tomato, Enviromentally friendly fertilizer, trichocompost, eco enzyme

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is a seasonal horticultural plant that belongs to the Solanaceae family. Tomatoes are one of the most widely consumed vegetables in Indonesia. Tomato is one of the most popular fruits in the community because it tastes good, fresh and slightly sour. Tomatoes also contain vitamins, minerals and other substances that are important for humans (Marliah *et al*., 2012; Kartika *et al*., 2021). Tomatoes are one type of horticultural plant that has increasing economic capabilities. According to data from the Central Bureau of Statistics (2023), tomato production in Indonesia in 2022 reached 1.17 million tons, an increase of 2% (1.14 million tons) from the previous year. Tomato production in Indonesia faces an increase every year, but it is different from tomato production in South Sulawesi, which only reached 65,930 tons in 2022, while consumer demand reached 687.98 tons.

The increase in demand for tomato plants requires an increase in production. The low fruit production is not only influenced by the lack of nutrient supply but also the use of chemical fertilizers, however, the use of chemical fertilizers can damage soil quality which causes the soil to become marginal due to decreased soil fertility and

organic matter content, damaged soil structure and environmental pollution which will have an impact on reducing crop production and will have an impact on health if used sustainably and excessively (Dewi, 2022). Synthetic chemical fertilizers contain chemicals that can reduce microbes in the soil and damage soil structure. Therefore, efforts that can be made in overcoming the limited supply of plant nutrients are the use of appropriate nutrients and reducing the use of chemical fertilizers so as to increase tomato production. Providing nutrients is one of the efforts to add nutrients to plants and to reduce the use of chemical fertilizers with environmentally friendly organic fertilizers such as trichocompost and utilize organic materials that will be processed into eco enzyme liquid.

Trichocompost is an organic fertilizer made from trichoderma sp. and compost (Isnaini, 2022). Trichocompost contains three things that are important for plants, namely nutrients, organic matter and trichoderma sp. Agricultural Research and Development Agency, 2019). Trichoderma sp functions as a decomposer of organic matter, while increasing plant productivity. Trichoderma sp. fungi act as biological agents, activators of other soil microorganisms and stimulators of plant development. Compost using trichoderma sp is also proven to reduce the dose of chemical fertilizers by 25% in sweet corn cultivation (Kusparwanti *et al*,. 2020). Nutrients N, P, K are nutrients that are important for plant growth. The addition of N, P, K elements must be done every year or at the beginning of planting to maintain the availability of nutrients in the soil to meet the needs of plants (Rohman and Azizah, 2021).

The use of trichocompost to increase biological activity for beneficial soil microorganisms, increase soil fertility and can provide a positive reaction to the development and yield of various types of plants (Masulili *et al*,. 2022). The results showed that the treatment of trichocompost dose of 10 tons ha-1 can increase soybean growth and production better than the treatment without trichocompost, 5 t ha^{-1}, 15 t ha^{-1}, 20 tons ha^{-1} (Lestari, 2022). Research on trichocompost shows an improvement in soil quality such as increasing soil pH and can increase plant growth and production. Based on the results of laboratory test analysis of the nutrient content contained in trichocompost, namely N (1.13%), P (0.84 ppm) and K (1.05 (cmol (+) kg^{-1}).

Eco enzyme is the result of fermentation of kitchen waste derived from kitchen waste from organic materials such as fruit pulp, fruit peels and vegetables. The principle of making eco enzymes is the same as making compost but in the process of making eco enzymes plus water which will be used as a growth medium so as to produce a final product in the form of a liquid, this is what causes eco enzymes to be preferred because they are easier to use (Astuti *et al*., 2020). The manufacture of eco enzymes needs to be fermented, the fermentation results of eco enzymes have a dark brown color and a strong aroma (Hemalatha and Visantini, 2020). Eco enzymes can help plants in increasing plant growth, can reduce waste (Chandra *et al*., 2020). Eco enzymes can be used by watering the soil surface or directly sprayed onto plants (Jelita, 2022). Based on the results of laboratory test analysis, the content of nutrients contained in eco enzymes include N (0.21%), P (12.85 ppm) and K (0.32% (cmol (+) kg^{-1})). The concentration of eco enzymes 6 ml/liter of water on peanut can give the best effect on the parameters of the number of filled pods per plant, dry seed production and dry seed production per hectare (Sepu,. 2023).

The use of trichocompost and eco enzymes from a combination of compost and residual organic matter is good for overcoming soil problems and the growth and yield of tomato plants, however, no one has reported on the combination of dosing trichocompost and eco enzymes as a provider of nutrients for the growth and yield of tomato plants.

RESEARCH METHODS

Location, Time, and Type of Research Data

This research was conducted at Experimental Farm, Faculty of Agriculture, Hasanuddin University, Makassar. This research was conducted from November 2023 to March 2024.

This research was a 2-factor factorial experiment (F2F) and used a randomized group design (RAK), as the environmental design.

The first factor is the dose of trichocompost (T) which consists of :

t0: 0 t ha^{-1}

t1 : 10 t ha^{-1}

t2 : 20 t ha^{-1}

The second factor is the concentration of eco enzyme (E) which consists of :

e0 : 0 mL L^{-1}

e1 : 3 mL L^{-1}

e2 : 6 mL L^{-1}

e3 : 9 mL L^{-1}

Thus there are 12 treatment combinations that are repeated 3 times so that there are 36 units of experimental plots.

RESULTS AND DISCUSSION

Results

Plant Height

The results of the analysis of variance showed that the dose of trichocompost gave a real effect, while the concentration of eco enzymes and the interaction between the dose of trichocompost and the concentration of eco enzymes had no real effect.

Table 1. Average height of tomato plants (cm)

Trichocompost Dose (t ha^{-1})	**Eco enzyme concentration (mL L^{-1})**				**Average**	**NP BNJ**
	0 (e0)	**3 (e1)**	**6 (e2)**	**9 (e3)**		
0 (t0	142,11	144,48	135,70	142,23	141,13 b	
10 (t1)	154,11	153,68	155,56	145,33	152,17 a	1,35
20 (t2)	151,62	156,92	155,45	149,35	153,33 a	

Notes: Numbers followed by the same letter (a,b) means not significantly different at BNJ test α 0.05.

Stem diameter

The results of the analysis of variance showed that the dose of trichocompost had a significant effect, while the concentration of eco enzymes and the interaction between the dose of trichocompost and the concentration of eco enzymes had no significant effect.

Table 2. Average stem diameter of tomato (mm)

Trichocompost Dose (t ha^{-1})	Eco enzyme concentration (mL L^{-1})				Average	NP BNJ
	0 (e0)	3 (e1)	6 (e2)	9 (e3)		
0 (t0	8,23	8,42	8,42	8,59	8,42 c	
10 (t1)	9,18	9,02	9,10	8,94	9,06 b	0,08
20 (t2)	9,61	9,52	9,63	9,29	9,51 a	

Notes: Numbers followed by the same letter (a,b,c) means not significantly different at BNJ test α 0.05.

Number of branches (branches)

The results of the analysis of variance showed that the dose of trichocompost gave a real effect, while the concentration of eco enzymes and the interaction between the dose of trichocompost and the concentration of eco enzymes had no real effect.

Table 3. Average number of branches (branches)

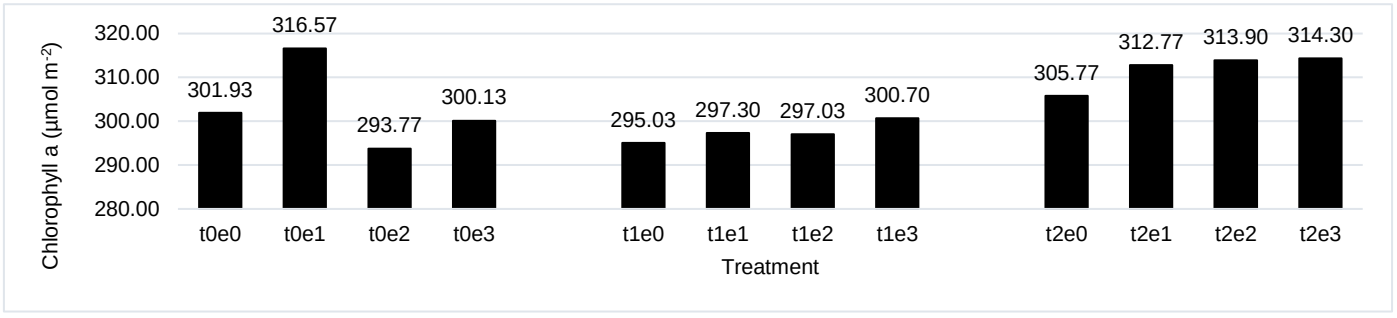
Trichocompost Dose (t ha^{-1})	Eco enzyme concentration (mL L^{-1})				Average	NP BNJ
	0 (e0)	3 (e1)	6 (e2)	9 (e3)		
0 (t0)	5,14	5,42	5,58	5,25	5,35 c	
10 (t1)	5,89	5,83	5,75	5,92	5,85 b	0,13
20 (t2)	6,53	6,58	6,83	6,75	6,67 a	

Notes: Numbers followed by the same letter (a,b,c) means not significantly different at BNJ test α 0.05.

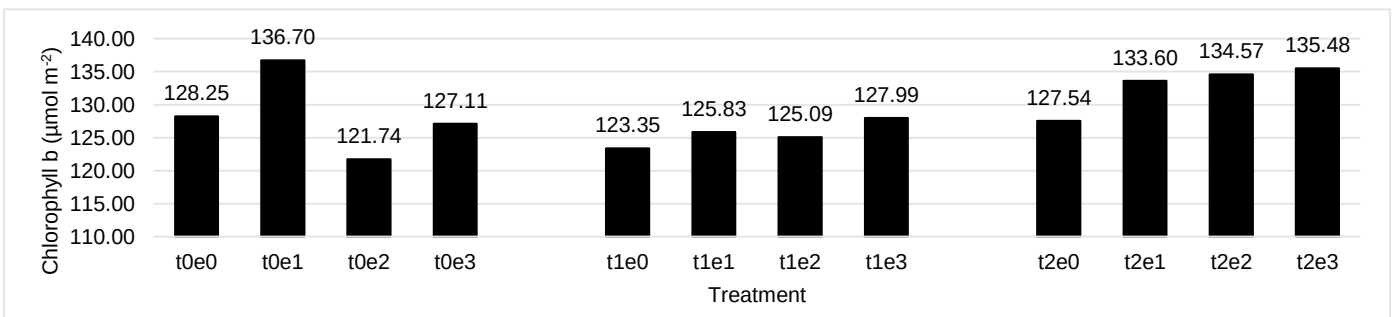
Leaf chlorophyll (µmol m^{-2})

The results of the analysis of variance showed that the dose of trichocompost, the concentration of eco enzymes and the interaction between the dose of trichocompost and the concentration of eco enzymes had no significant effect.

a.



b.



c.

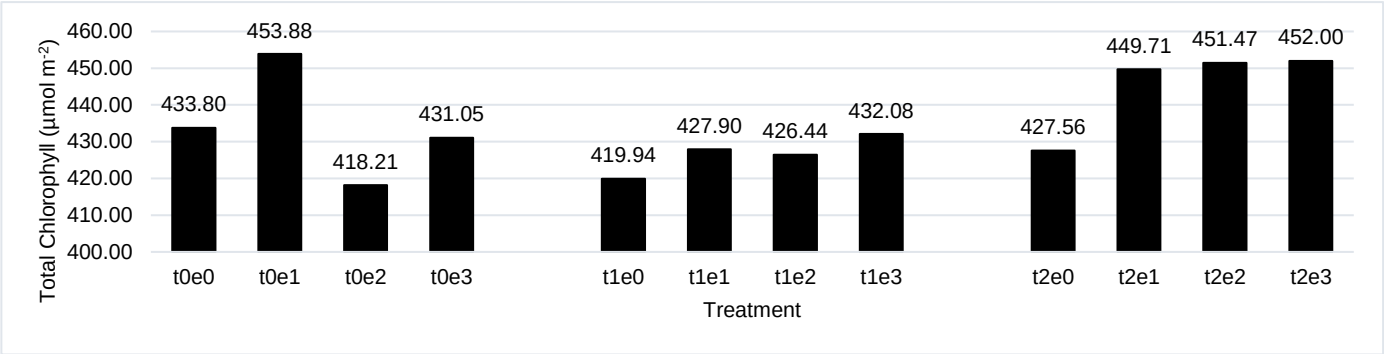


Figure 1. (a) Bar diagram of average chlorophyll a (µmol m^{-2}), (b) Bar diagram of average chlorophyll b (µmol m^{-2}), (c) Bar diagram of average total chlorophyll (µmol m^{-2})

Number of fruits per plant (fruit)

The results of the analysis of variance showed that the dose of trichocompost and the concentration of eco enzymes gave a very real effect, while the interaction between the dose of trichocompost and the concentration of eco enzymes had no real effect.

Table 4. Average number of fruits per plant (fruit)

Trichocompost Dose (t ha^{-1})	**Eco enzyme concentration (mL L^{-1})**				**Average**	**NP BNJ (t)**
	0 (e0)	**3 (e1)**	**6 (e2)**	**9 (e3)**		
0 (t0)	27,39	27,50	27,89	28,33	27,78 c	
10 (t1)	31,92	32,75	33,58	32,97	32,81 b	0,14
20 (t2)	35,17	36,08	36,92	36,75	36,23 a	
Average	31,49 r	32,11 q	32,80 p	32,69 p		
NP BNJ (e)			0,22			

Notes: Numbers followed by the same letter (a,b,c) or (p,q,r) mean not significantly different in the BNJ α 0.05.

Fruit weight per plant (g)

The results of the analysis of variance showed that the dose of trichocompost and the concentration of eco enzymes had a very significant effect, while the interaction between the dose of trichocompost and the concentration of eco enzymes had no significant effect.

Table 5. Average fruit weight per plant (g)

Trichocompost Dose (t ha^{-1})	**Eco enzyme concentration (mL L^{-1})**				**Average**	**NP BNJ (t)**
	0 (e0)	**3 (e1)**	**6 (e2)**	**9 (e3)**		
0 (t0)	1141,84	1162,56	1217,85	1215,57	1184,45 c	
10 (t1)	1388,66	1422,85	1499,92	1450,96	1440,60 b	7,57
20 (t2)	1587,20	1591,53	1601,53	1595,41	1593,92 a	
Average	1372,57 d	1392,31 c	1439,77 a	1420,65 b		
NP BNJ (e)			12,24			

Notes: Numbers followed by the same letter (a,b,c) or (p,q,r) mean not significantly different in the BNJ α 0.05.

Fruit weight per hectare (ton)

The results of the analysis of variance showed that the dose of trichocompost had a very significant effect, while the treatment of eco enzymes and the interaction between the dose of trichocompost and the concentration of eco enzymes had no significant effect.

Table 6. Average fruit weight per hectare (tons)

Trichocompost Dose (t ha^{-1})	**Eco enzyme concentration (mL L^{-1})**				**Average**	**NP BNJ (t)**
	0 (e0)	**3 (e1)**	**6 (e2)**	**9 (e3)**		
0 (t0)	55,32	57,13	59,48	60,21	58,03 c	
10 (t1)	66,49	67,29	72,13	69,17	68,77 b	0,74
20 (t2)	77,63	76,43	79,34	79,21	78,15 a	
Average	66,48 r	66,95 q	70,31 p	69,53 p		
NP BNJ (e)			1,19			

Notes: Numbers followed by the same letter (a,b,c) or (p,q,r) mean not significantly different in the BNJ α 0.05.

Discussion

Based on the results of the research that has been done, it can be seen that there is no interaction between trichocompost and eco enzymes on all observation parameters. This is thought to occur because the interaction of the two treatments is less supportive of each other and gives the best influence on one another, so that the effects that occur on plant roots cannot absorb nutrients properly. In accordance with the opinion of (Putra, 2022) which states that good plant growth and production can be achieved if the factors that influence balanced growth, one factor is stronger in its influence on other factors, then the other factors will be closed and each factor has different properties or ways of working will produce a relationship that has no real effect to support a plant growth.

The results showed that it gave a real influence on several observation parameters, namely plant height, stem diameter, number of branches, number of fruits per plant, fruit weight per plant and fruit weight per hectare. Plant height, stem diameter, number of branches, number of fruits per plant, fruit weight per plant and fruit weight per hectare were highest at a dose of 20 t ha^{-1} with an average plant height of 153.33 cm, stem diameter 9.51 mm, number of branches 6.67 branches, number of fruits per plant 36.23 fruits, fruit weight per plant 1593.92 g and fruit weight per hectare 78.15 tons. Trichocompost gives good results on the growth and production of tomato plants. Significantly, the higher the dose of trichocompost, the higher the growth and production of plants and the impact on the amount of stem diameter, number of branches and total soluble solids where trichocompost not only increases the quantity but also the quality of tomato crop yields. The use of trichocompost showed an effect on the highest plant height variable. This is influenced by the nutrients available and absorbed by plants. However, trichocompost can meet the needs of nutrients in plants, this is because trichocompost as an organic fertilizer can improve the physical and chemical properties of the soil thereby increasing the availability of nutrients in the soil. Umbola *et al*,. (2020) stated that P and K elements play a very important role in increasing the diameter of plant stems, especially in their role as a network that connects between roots and leaves, with the availability of P and

K nutrients, carbohydrate formation will run well and strengthen plant tissues and starch translocation to the stem will be smoother, so that it can affect the increase in stem diameter.

The number of fruits per plant and the number of fruits per dompol in trichocompost is rich in phosphorus nutrients that can support fruit formation in plants. Trichocompost also increases the activity of soil microorganisms that support plant health. Research by Rahma *et al*. (2021) showed that the addition of Trichocompost as much as 20 t ha^{-1} has high results in supporting the formation of cucumber fruit, this is due to the content of P nutrients in trichocompost has a role in stimulating fruit formation in plants.

CONCLUSION

Based on the results of the discussion in this study, it can be concluded that the interaction between the treatment of trichocompost and eco enzymes had no real effect. The results showed that the treatment of trichocompost 20 t ha^{-1} and eco enzyme 6 mL L^{-1} can have a good effect on the growth and production of tomato plants.

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