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RESPONSE OF ADMINISTRATION OF TRICHOCOMPOST AND ECO ENZYME SOIL IMPROVEMENT ON GROWTH AND PRODUCTION OF GLASS GEM CORN (Zea mays L.)

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Abstract

The main objective of this research is to determine the growth response and production of glass gem corn plants (Zea mays L.) using trichocompost soil amendments and the application of eco enzyme. This research used a factorial randomized block design (RAK) consisting of 2 treatment factors with 16 combinations and 3 replications to obtain a total of 48 plots. The parameters observed in this study were Vegetative Growth which consisted of flower age, plant height, number of leaves, root length, leaf area, stem diameter, net assimilation rate, fresh and dry root weight, shoot fresh and dry weight, plant growth rate. . The second observation is production which consists of cob length, cob diameter, cob weight per sample, cob weight with sample husks/plants. The research results showed that the results of the analysis of trichocompost fertilizer content were Nitrogen 1.93%, P2O5 1.93%, K2O 3.56; C-Organic 25.35%; Cu 23.29 Ppm, Fe 0.23%, Mn 181.95 Ppm, Zn 0.01 Ppm, pH 8.71, and water content of 50.50%. Furthermore, the results of the analysis of the eco enzyme fertilizer content are Nitrogen 0.25%, P2O5 0.02, K2O 0.04; C-Organic 0.93%; Cu >0.0002 Ppm, Fe 34.44 Ppm Mn 4.43 Ppm, Zn 0.01 Ppm, pH .25. The use of fruit waste as liquid organic fertilizer and cow dung as organic fertilizer is effectively used to increase the growth rate and productivity of corn plants, especially galss gem corn.

Keywords: Trichokompos, Eco Enzyme, Glass Gem Corn

INTRODUCTION

Corn is a type of grain food plant from the grass family. This plant is an important food crop, besides wheat and rice. The corn plant originates from America and spread to Asia and Africa through European business activities in America. Around the 16th century, the Portuguese spread it to Asia, including Indonesia (Khair et al, 2015). Based on a report from the website of the Ministry of Agriculture of the Republic of Indonesia (2021), it is reported that the availability of food commodities, especially corn, will continue to be boosted in production until it meets needs or even reaches a surplus to be able to carry out export activities. The national corn production prognosis with a moisture content of 15% for the period January to December 2020 has reached 24.95 million tons of dry shell. This amount is known to be sufficient for corn needs in 2020, as reported by the Commodity Futures Trading Supervisory Agency (BAPPEBTI), that the projected need for corn in 2020 is 8.5 million tons for feed factories and around 3.48 million tons for livestock farmers' needs. independent. The need for corn outside the needs of independent farmers and self-mixers is around 500,000 – 600,000 tons per month. Therefore, it is hoped that in the following year Indonesia will achieve a corn surplus (Nabila, 2022).

Glass Gem Corn (Zea mays L.) or commonly known as rainbow corn is a type of corn that has not long been known abroad and has been developed in Cianjur, West Java, Indonesia. Glass Gem corn (Zea mays L.) is widely known as a food crop, animal feed, main industrial ingredient, and model plant for learning and research objects. The function of corn, especially 'Glass Gem' corn, as an ornamental plant is not well known to the public and not much information is available. This glass gem corn or Rainbow corn does have more starch than regular corn. That explains why it doesn't taste as crisp as usual. The skin tends to be harder, usually referred to as flint corn, it is not eaten directly from the stalk, this corn is ground to produce corn flour which is then made into various foods such as corn porridge or tortillas. The daily need for corn continues to increase along with the increase in

Indonesia's population. In 2018, corn imports in Indonesia reached 72,710 tons. This indicates that national corn production has not been able to meet market demand. One of the large corn production centers is in the East Java region, namely Kediri district. According to the East Java Province Central Statistics Agency, in 2017, corn production in Kediri Regency amounted to 345,757 tons. In North Sumatra Province itself, according to the Central Statistics Agency in 2023, corn production in 2020 was 1,965,444 tons with a harvest area of 321,184 ha, while in 2021 it was 1,724,398 tons with a harvest area of 273,703 ha, in 2022 it increased to 1,806 ,544 with a harvest area of 289,238 ha (BPS, 2023). However, this increase has not yet met consumer demand, which has also increased.

Efforts that can be made to increase the production and quality of corn plants can be done in several ways, one of which is by fertilizing both organic fertilizer and chemical (inorganic) fertilizer. 4 The tendency of excessive use of chemical (inorganic) fertilizers can have an impact on environmental pollution, besides that continuous use over a long period of time can have an impact on decreasing land productivity, such as the degree of acidity, structure, texture and nutrient content of the soil (Ainiya et al. , 2019). The most practical improvement in soil fertility conditions is by adding organic matter to the soil. Organic material will be broken down by microorganisms in the soil which is processed into nutrients needed by plants. One of the organic materials that will be provided is trichocompost. Trichokompos is an organic compost fertilizer made from organic materials and contains the antagonistic fungus Trichoderma sp 5 (Nurnawati et al, 2022). Trichocompost can play a role in improving soil structure, maintaining soil moisture and as a nutrient buffer that plants need in the development and process of fruit enlargement (Hartati et al, 2016). Trichocompost applied to the soil can provide benefits, including containing macro and micro nutrients, improving soil structure, facilitating plant root growth and retaining water as well as increasing the biological activity of beneficial soil microorganisms (BPTP Jambi, 2009).

Providing organic fertilizer with biostimulant properties. Biostimulants are a type of organic compound which in small amounts can support and improve plant growth and development. The use of eco enzymes in the agricultural sector has been widely used, including as a soaking solution in the process of selecting seeds and cultivating rice seeds, using it as a liquid organic fertilizer for pakcoy mustard plants (Kamila and Winarsih, 2023; Novriani, 2019), as a renovator of organic matter, a stimulant growth, as an agent for controlling plant pests and diseases (Susilowati, et. al., 2021), and increasing the nutrient content in the soil (Lumbanraja, et. al., 2021; Wiryono, et. al., 2021). Eco enzyme is a solution of complex organic substances produced from the fermentation process of leftover organic waste, sugar and water. This eco enzyme liquid is dark brown in color and has a strong sour/fresh aroma. This process requires a fermentation time of three months (Pakki et al, 2021).

Eco enzyme is a liquid that can be used for various purposes which is obtained from anaerobic fermentation of fruit and vegetable peel waste for 3 months or more (Alkadri et al, 2020). This fermentation creates an acid like liquid with natural proteins, mineral salts and enzymes. These enzymes in corn plants act as biostimulants. According to Jardin (2015) biostimulants are formulas consisting of bioactive plant compounds or microorganisms that are applied to plants to increase the efficiency of nutrient absorption, tolerate abioic stress, and improve plant quality. Based on the description above, by providing soil amendments with trichocompost and eco enzyme, it is hoped that it will be able to increase the growth and production of Glass Gem Corn (Zea mays L.) plants.

RESEARCH METHODOLOGY

This research will be carried out in Datar Village, Hamparan Perak District, Deli Serdang Regency, North Sumatra Province with an altitude of ±25 meters above sea level, with flat topography. This research will begin in December 2023 until completion. This research used a factorial randomized block design (RAK) consisting of 2 treatment factors with 16 combinations and 3 replications so that a total of 48 research treatment plots were obtained. The Ecoenzym Dosing Factor with the symbol "E" consists of 4 levels, namely: E0 : 0 ml/l water (Control) E1 : 10 ml/l water E2 : 15 ml/l water E3 : 20 ml/l water. The factor for giving trichocompost with the symbol "T" consists of 4 levels, namely: T0 : 0 kg /plant (Control) T1 : 3.4 kg /Plot T2 : 4.5 kg/Plot T3 : 5.6 kg/Plot.

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The research began with making eco enzyme and Trichokompos. The production of ecoenzyme takes 3 months. Next, trichocompost will be made at the same time, which must be covered with a tarpaulin for approximately 14 days. Trichokompos will be given 1 week before planting. Next, eco enzyme is given 3 times during planting, namely 2 WAP, 4 WAP, and 6 WAP. Number of Treatments = 2 treatment factors; Number of repetitions = 3 repetitions; Number of Plots = 48 Plots; Plot area = 1.5 m x 2 m ; Plant spacing = 30 cm x 50 cm; Number of Plants Per Plot = 20 Plants; Number of Sample Plants = 6 Plants/Plot; Number of Deductive Plants = 5 Plants/Plot ; Distance between plots = 50 cm. Distance between replicates = 100 cm.

RESEARCH RESULTS AND DISCUSSION

Plant Height (cm)

The results of the analysis of variance showed that the application of trichocompost and eco enzyme fertilizer had a significant effect on plant height at observations 3, 5 and 7 WAP. The results of the test of the difference between the average treatment of trichocompost fertilizer and the dose of eco enzyme on the height of glass gem corn plants at the age of 7 WAP can be seen in Table 1.

Table 1. Height of the glass corn plants with the provision of Trichokompos and eco enzyme umut &MST

Perlakuan	*Eco Enzym* (E)				Rerata T
	E_0	E_1	E_2	E_3	
Trichokompos (T)					
T_0	119,44	163,22	165,83	153,89	150,60 a
T_1	175,89	184,83	174,22	171,33	176,57 b
T_2	182,78	190,78	188,06	197,94	189,89 c
T_3	181,89	186,28	190,78	187,11	186,51 bc
Rerata E	165,00	181,28	179,72	177,57	

Keterangan : Angka diikuti huruf yang tidak sama pada kolom dan baris perlakuan yang sama berbeda nyata pada taraf 5 % berdasarkan uji DMRT.

Table 1 shows that the height of glass gem corn plants aged 7 WAP there is a significant difference between the average plant height in treatment T0 and other treatments ($p<0.05$), except between treatment T2 and treatments T3 and T1 which did not show a significant difference. The lowest mean was in treatment T0 (without treatment) namely 150.60 cm which was significantly different from the other treatments. The highest mean was in treatment T2 (Trichocompost 4.5 kg/plot) namely 189.89 cm which was not significantly different in treatment T3 (Trichocompost 5.6 kg/plot) namely 186.51cm and treatment T1 (Trichocompost 3.4 kg/plot). plot) namely 176.57 cm. This shows that the gradual increase in plant height along with increasing plant age shows that trichocompost fertilizer has a positive effect in increasing the growth of glass gem corn plants at the 7 WAP growth stage. Even though there was no significant difference between treatments T2, T3, and T1, the average plant height in treatment T2 tended to be higher than the others. Factors that may cause this increase include higher nutrient content in trichocompost fertilizer, increased nutrient availability for plants, and increased soil microbial activity.

This is because trichocompost fertilizer contains a composition of C-Organic 25.35%, N 1.93%, P 1.93%, K 3.56% and pH 8.71. This is supported by the opinion of Lorenza, et. al., (2016) who stated that tall plants will have lots of leaves and high leaf area values because there is a fairly close correlation between the growth characteristics of these plants. Increasing the dose of trichocompost fertilizer does not mean that the observed value will also be higher. The response of plant growth to the treatment dose of trichocompost fertilizer tends to be significant, which means there is an optimal dose that will produce the best growth. An increase in the height of glass gem corn plants can occur due to the influence of adding trichocompost organic material, based on research by Fitrah and Amir (2015), providing organic fertilizer can increase plant growth. Rosita et. al., (2005) stated that plant growth increases with increasing plant age. The increased growth of this plant is due to the addition of organic material.

Number of Leaves (Strands)

The results of the analysis of variance showed that the application of trichocompost had a significant effect on the number of leaves at observations 3, 5 and 7 WAP. The administration of eco enzyme did not have a significant effect on the number of leaves at the ages of 3, 5 and 7 WAP. The interaction of the two treatments of trichocompost fertilizer and eco enzyme did not have a significant effect at the age of 3-7 WAP, however there was an increase in the number of glass gem corn leaves at each observation. The results of the test for the difference in mean treatment of trichocompost fertilizer and the dose of eco enzyme on the number of glass gem corn leaves at the age of 7 WAP can be seen in Table 2.

Table 2. Number of Glass Gem Corn Leaves with Trichokompos and Eco Enzyme at 7 WAP

Perlakuan	*Eco Enzym* (E)				Rerata T
	E_0	E_1	E_2	E_3	
Trichokompos (T)					
T_0	7,00	8,28	8,22	7,56	7,76 a
T_1	9,06	9,50	9,22	9,11	9,22 b
T_2	9,61	9,56	9,28	9,89	9,58 b
T_3	9,11	8,94	9,39	9,50	9,24 b
Rerata E	8,70	9,07	9,03	9,02	

Keterangan : Angka diikuti huruf yang tidak sama pada kolom dan baris perlakuan yang sama berbeda nyata pada taraf 5 % berdasarkan uji DMRT.

Table 4.4 statistical analysis of the number of glass gem corn leaves aged 7 WAP shows that the trichocompost fertilizer treatment had an effect or was significantly different ($P<0.05$). The lowest mean was in treatment T0 (without treatment), namely 7.76 strands, which was significantly different from the other treatments. The highest mean was in treatment T2 (Trichocompost 4.5 kg/plot), namely 9.58 strands, which was not significantly different in treatment T3 (Trichocompost 5.6 kg/plot), namely 9.24 strands and treatment T1 (Trichocompost 3.4 kg /plot) which is 9.22 strands. This shows that the use of trichocompost fertilizer causes a significant increase in the number of leaves, without greatly affecting the dose administered.

These results indicate that trichocompost fertilizer has the potential to increase the growth of glass gem corn plants at the 7 WAP growth stage. This is because trichocompost fertilizer contains a C-Organic composition of 25.35%, N 1.93%, P 1.93%, K 3.56% and pH 8.71. According to Ainiya, et. al., (2019) stated that the number of leaves will increase if the food/nutrient sources are sufficient, in this case the trichocompost treatment can significantly increase the number of leaves at a treatment dose of 4.5 kg/plot and is not significantly different from a treatment dose of 5. 6 kg/plot. Abundant chlorophyll obtained from lush leaves supports optimal photosynthesis processes. The results of the photosynthesis process are used as a food source for plants for their growth (Setyanti, 2013). A large number of leaves supports optimal photosynthesis processes.

Leaf Area (cm2)

The results of the variance analysis showed that the application of trichocompost fertilizer had a significant effect on leaf area at 3, 5 and 7 WAP observations. Dosing with eco enzyme did not have a significant effect on leaf area at 3, 5 and 7 WAP. The interaction of the two trichocompost fertilizer treatments and the eco enzyme dose did not have a significant effect at 3 WAP, but a significant effect was seen at 5 and 7 WAP. The test results of the difference in mean treatment of trichocompost fertilizer and eco enzyme dose on glass gem corn leaf area at 7 WAP can be seen in Table 3.

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Table 3. Area of Glass Gem Corn Leaves with Trichokompos and Eco Enzyme at 7 WAP

Perlakuan	*Eco Enzym* (E)				Rerata T
	E_0	E_1	E_2	E_3	
Trichokompos (T)					
T_0	31,85 a	41,09 bc	40,59 bc	38,81 b	38,09 a
T_1	42,27 bc	42,59 bc	40,59 bc	40,28 bc	41,43 b
T_2	40,57 bc	39,09 bc	42,77 bc	43,55 c	41,50 b
T_3	42,32 bc	42,09 bc	43,27 bc	42,31 bc	42,50 b
Rerata E	39,25	41,22	41,81	41,24	

Keterangan : Angka diikuti huruf yang tidak sama pada kolom dan baris perlakuan yang sama berbeda nyata pada taraf 5 % berdasarkan uji DMRT.

Table 4.6 statistical analysis of glass gem corn leaf area aged 7 WAP shows that trichocompost fertilizer treatment had an effect or was significantly different (P<0.05).The lowest mean was in treatment T0 (without treatment) namely 38.09 cm2 which was significantly different from the other treatments. The highest mean was in treatment T3 (Trichocompost 5.6 kg/plot), namely 42.50 cm2, which was not significantly different from treatment T2 (Trichocompost 4.5 kg/plot), namely 41.50 cm2, and treatment T1 (Trichocompost 3.4 kg/plot) which is 41.43 cm2. This shows that the application of trichocompost fertilizer, especially at the highest dose (5.6 kg/plot), can significantly increase the leaf area of glass gem corn at 7 WAP. Although there were slight variations between fertilizer doses, these differences were statistically significant. This is because trichocompost fertilizer contains a C-Organic composition of 25.35%, N 1.93%, P 1.93%, K 3.56% and pH 8.71.

According to Atmojo (2003), organic matter is a source of energy for soil microorganisms. The addition of organic matter to the soil will increase the activity of microorganisms, especially the decomposition and mineralization activity of organic matter in the soil. Increased decomposition and mineralization activities cause the availability of nutrients in the soil 57 to increase. Lingga (2015) stated that the use of organic fertilizer plays a very big role in efforts to improve the condition and resistance of the soil to erosion and improve soil structure and can make the soil more fertile. The smallest leaf area is produced without trichocompost fertilizer, this is because there are no supporting factors to create more fertile soil conditions.

Bar Diameter

The results of the analysis of variance showed that the application of trichocompost fertilizer had a significant effect on stem diameter at observations 3, 5 and 7 WAP. Dosing with eco enzyme had no significant effect on stem diameter at 3, 5 and 7 WAP. The interaction of the two trichocompost fertilizer treatments and the dose of eco enzyme did not have a significant effect at the age of 3 and 7 WAP, but a significant effect was seen at the age of 5 WAP. The results of the test for the difference in mean treatment of trichocompost fertilizer and the dose of eco enzyme on the stem diameter of glass gem corn at the age of 7 WAP can be seen in Table 4.

Table 4. Diameter of Glas Gem Corn Stems with Trichokompos and Eco Enzyme 7 WAP

Perlakuan	*Eco Enzym* (E)				Rerata T
	E_0	E_1	E_2	E_3	
Trichokompos (T)					
T_0	1,97	2,36	2,46	2,34	2,29 a
T_1	2,60	2,50	2,41	2,43	2,49 b
T_2	2,56	2,62	2,73	2,82	2,69 c
T_3	2,61	2,61	2,68	2,62	2,63 c
Rerata E	2,44	2,52	2,57	2,55	

Keterangan : Angka diikuti huruf yang tidak sama pada kolom dan baris perlakuan yang sama berbeda nyata pada taraf 5 % berdasarkan uji DMRT.

Table 4.5 statistical analysis of stem diameter of glass gem corn aged 7 WAP shows that trichocompost fertilizer treatment had an effect or was significantly different (P<0.05). The lowest mean was in treatment T0 (without treatment), namely 2.29 cm, which was significantly different from the other treatments. The highest mean was in treatment T2 (Trichokompos 4.5 kg/plot) namely

2.69 cm, which was not significantly different from treatment T3 (Trichokompos 5.6 kg/plot) namely 2.36 cm but was significantly different from treatment T1 (Trichokompos 3.4 kg/plot) which is 2.49 cm. These results indicate that the application of trichocompost fertilizer, especially at a dose of 4.5 kg/plot, can increase the stem diameter of glass gem corn plants at 7 WAP. Although there is a slight variation between fertilizer doses, this difference is quite statistically significant, this shows that a trichocompost fertilizer dose of 4.5 kg/plot is able to increase the stem diameter of glass gem corn. This is because trichocompost fertilizer contains a C-Organic composition of 25.35%, N 1.93%, P 1.93%, K 3.56% and pH 8.71. According to Novizan (2010), giving trichocompost fertilizer will really help plants to grow and develop well. The elements N, P, and K are macro nutrients that plants absorb from the soil. They are needed in quite large quantities and if there is a lack of these elements, plant growth will be hampered.

According to Ichwan (2007), the application of trichocompost fertilizer is thought to be more likely to improve the physical and biological properties of the soil, besides that trichoderma can also function as a biological agent and plant growth stimulator (Nurahmi, et. al., 2012). Like other living creatures, plants also need adequate nutrition for life. These nutrients are nutrients, both macro and micro, which can support the production and growth process. Some of the nutrients needed by plants and found in eco enzymes are 55 Nitrogen (N), Phosphorus (P), and Potassium (K). Nitrogen is a type of nutrient that is important for stimulating vegetative growth, the formation of protein, chlorophyll and nucleic acids so it must be available to plants (Rahma, 2018). Phosphorus (P) for plants can encourage root development, flower emergence, fruit ripening, seed formation and plays an important role in storing and distributing energy to all plant cells (Jalaluddin and Syafrina, 2017). Potassium (K) plays a role in plant vegetative growth to improve the transport of assimilate, regulate the opening and closing of stomata to reduce water consumption, and increase plant immunity to avoid pest or disease attacks (Mahdiannoor et. al., 2016).

Root Length (cm)

The results of the analysis of variance showed that the application of trichocompost fertilizer and the dose of eco enzyme as well as the interaction of the two treatments had a significant effect on the root length of glass gem corn plants. The test results of the difference in mean treatment of trichocompost fertilizer and eco enzyme dosage on the root length of glass gem corn can be seen in Table 5.

Table 5. Length of Glass Gem Corn Roots with Trichokompos and Eco Enzyme

Perlakuan	*Eco Enzym* (E)				Rerata T
	E_0	E_1	E_2	E_3	
Trichokompos (T)					
T_0	16,83 a	22,31 bcde	22,08 bcd	20,66 b	20,47 a
T_1	22,03 bcd	22,28 bcde	21,62 bc	21,20 b	21,78 b
T_2	22,04 bcd	23,95 cdef	25,97 fg	27,27 g	24,81 c
T_3	25,42 fg	24,83 efg	25,16 fg	24,42 def	24,96 c
Rerata E	21,58 a	23,34 b	23,71 b	23,39 b	

Keterangan : Angka diikuti huruf yang tidak sama pada kolom dan baris perlakuan yang sama berbeda nyata pada taraf 5 % berdasarkan uji DMRT.

Table 5, statistical analysis shows that trichocompost fertilizer treatment has a significant effect on the root length of glass gem corn plants. The lowest mean was in treatment T0 (without treatment), namely 20.47 cm, which was significantly different from other treatments. The highest mean was in treatment T3 (Trichokompos 5.6 kg/plot) namely 24.96 cm which was not significantly different from treatment T2 (Trichokompos 4.5 kg/plot) namely 24.81 cm, but significantly different from treatment T1 (Trichokompos 3.4 kg/plot) namely 21.78 cm. It is suspected that treatment with a trichocompost fertilizer dose of 5.6 kg/plot (T3) showed the highest results in root length, but a dose of 4.5 kg/plot (T2) also gave results that were not significantly different. This is because trichocompost fertilizer contains a C-Organic composition of 25.35%, N 1.93%, P 1.93%, K 3.56% and pH 8.71. This shows that the application of trichocompost fertilizer can significantly increase the root growth of glass gem corn plants, especially at higher doses. Trichocompost fertilizer is classified as organic fertilizer which is the result of the decomposition of organic materials which are broken

down (broken down) by microbes, the final result of which can provide the nutrients needed by plants (Supartha et. al., 2012).

In line with research by Bagus et. al., (2016), giving trichocompost at 15 tons/ha makes the soil loose, increases the stability of the soil structure, increases the formation of better soil aggregates which has an impact on improving aeration and drainage. Providing trichocompost fertilizer can cause loose soil conditions, thereby increasing plant root development which also has an impact on increasing nutrient absorption.

CLOSING

Conclusion

1. Providing trichocompost fertilizer affects the growth of plant height, number of leaves, stem diameter, leaf area, root length. The best treatment was found in T2 (trichocompost fertilizer 4.5 kg/plot).
2. Eco enzyme treatment affects length. But it does not affect the growth of plant height, number of leaves, stem diameter, leaf area. The best treatment is E2 (eco enzyme 15 ml/l).
3. The interaction of the two treatments of trichocompost fertilizer and eco enzyme affects leaf area and root length. But it does not affect plant height, number of leaves, stem diameter. The best treatment was T2E3 (trichocompost fertilizer 4.5 kg/plot and eco enzyme 20 ml/l).

Suggestion

Further research needs to focus on the implementation of trichocompost fertilizer and eco enzyme application techniques to maximize plant growth and production so that agricultural food yields can be increased sustainably and efficiently.

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