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Growth Potential of Sunflower Sprouts with Mole Natural Fertilizer or Ecoenzyme from Orange Peel

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Abstract

This research focuses on the utilization of ecoenzymes from the fermentation of organic waste of citrus fruit peel, brown sugar, and water to see the effectiveness of sunflower sprouts plant growth. Experiments were conducted in the science laboratory of MTsN Model 1 Banda Aceh between December 2022 and April 2023 with a complete randomized design factorial pattern (5x4) with 4 replications. The treatments of ecoenzyme (P) were P0 (water), P1 (15 ml ecoenzyme + 385 ml water), P2 (20 ml ecoenzyme + 480 ml water), and P3 (30 ml ecoenzyme + 470 ml water). The results showed a significant interaction between treatments 1, 2, and 3 on plant height and number of leaves. The best results were shown by P3 treatment with 30 ml ecoenzyme and 470 ml water. Although the first week did not show a significant interaction, the other treatments had a significant impact on the observed parameters. Therefore, the use of ecoenzyme from orange peel organic matter can effectively increase the growth of sunflower sprouts.

Keyword: Sunflower; Helianthus annus L; Sprouts; Ecoenzymes; Orange peel waste

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INTRODUCTION

The increase of waste in Indonesia is influenced by the increasing population growth (Mahyudin, 2017). Indonesia produces around 7.2 million tons of waste annually, with most of it coming from urban areas (Larasati, Astuti, & Maharani, 2020). Although only 1% of this waste is food waste classified as organic waste, there are still obstacles in public awareness of the importance of waste recycling. The way waste is disposed of is generally by burning (66.8% of households) and the low level of recycling awareness (1.2%) causes air pollution and serious health problems (Cristina, 2024; Munidar, 2024; Paull, 2024; Rahmadani, 2024; Johan, 2024).

Raising public awareness about waste management requires cooperation from various parties, including the community and government (Etienne, Genard, Lobit, Mbeguie-Ambeguie, & Bugaud, 2013). It takes a long time to build this awareness, and consistency from decision-makers is essential. One effective way to address waste management issues is to change the characteristics, composition, and amount of waste through proper treatment. One example is processing orange peel waste that is generally not utilized. This waste can be converted into ecoenzyme through fermentation, an environmentally friendly product that can be used as liquid organic fertilizer, natural insect repellent, and improve soil quality (Abdullah, Saputri, & Nasywa, 2022).

Ecoenzyme is a solution made by fermenting complex organic compounds from organic waste such as vegetables and fruits with a mixture of sugar and water (Salsabila & Winarsih, 2023). The enzyme production obtained from the fermentation process is dark brown in color having amylase and typical sweet fermen (Verma, N., & A.K, 2019). Ecoenzymes have several uses such as effective disinfectants and cleaning agents, as well as organic materials that can be used in livestock, households, and agriculture (Dhiman, 2017).

These ecoenzymes can also be used in plant cultivation, such as sunflower (Helianthus annus L) sprouts, which are rich in health benefits and nutrients (Putri, 2020). Sunflower sprouts are one of the most popular sprouted vegetables because of their high nutritional content, including folate, vitamin C, vitamin K, iron, and high potassium, and contain antioxidant compounds such as sulforaphane (Fajrin, Sesanti, Maulana, Sismanto, & Hamiranti, 2023). Based on previous research conducted by (Salsabila & Winarsih, 2023), information was obtained that the provision of ecoenzymes from organic waste on the growth of pakcoy mustard plants (Lactuca sativa L.) had a significant effect on plant growth, namely plant height, number of leaves, root length, and wet biomass of pakcoy plants (Rahmad, 2023; Tiara, 2022; Misbah, 2019; Abthal, 2024; Zikrullah, 2023).

Through this research, it is hoped that the production of environmentally friendly ecoenzymes can be a solution to the problem of waste in the environment, both organic and inorganic. Solution to waste problems in the environment, both organic and inorganic. In addition, the application of ecoenzyme as liquid organic fertilizer is also expected to be an alternative to the use of fertilizers in plants (Nurhamidah, Amida, Rohiat, & Elvinawati, 2021). Based on this background, this study was conducted with the aim of knowing the effect of the application and optimal concentration of ecoenzyme as a liquid organic fertilizer on the growth of sunflower (Helianthus annuus L.) sprouts, namely plant height and number of leaves.

METHOD

This type of research has two stages of research, namely descriptive and experimental research stages. These stages include making ecoenzymes and observing the growth and development

of sunflower sprouts. The research was carried out by preparing sunflower sprouts seeds that were 7 days old. After the age of 7 days the plant has appeared 1 - 2 leaves continued sowing sunflower seeds and transferred to experimental pots. The soil media in this sunflower sprout plant uses organic fertilizer. Harvesting is done at the age of 30 (HST). Before harvesting, the physical appearance of plants such as leaf color, leaf shape, and leaf size were seen.

The subject of this study was 60 sunflower sprouts in 20 polybags where in each polybag there were 3 sunflower sprouts.

This study used a completely randomized design (CRD) with 4 treatments repeated 5 times, so that there were 20 research plots with the treatment of orange peel ecoenzyme consisting of 4 levels, namely: P0 = No treatment, P1 = ecoenzyme 15 cc/ 485 ml water, P2 = ecoenzyme 20 cc/ 480 ml water and P3 = ecoenzyme 30 cc/ 470 ml water.

The data obtained were then analyzed statistically using Analysis of Variance (ANSIRA), if from the Analysis of Variance obtained results that were significantly different (Fcount> Ftable 1%) and or significantly different (Fcount> Ftable 5%) then to compare between the two treatments further tests were carried out the smallest real difference (BNT) at the 5% level.

FINDING AND DISCUSSION

Finding

The application of ecoenzymes from citrus fruit peels to sunflower sprouts has a significant effect on the growth of stem height and number of leaves. The average plant height of sunflower sprouts in the third week was about 29-34 cm and the average number of leaves of sunflower sprouts in the third week was 6 to 11 leaves. The results of the research obtained in the test based on the observed plant parameters including plant height and number of leaves can be seen as follows. The results of stem height observations in week 1 are presented in Table 4.1 below.

Table 1. Stem Height in Week 1

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	5,9	6,2	4	7,3	2,4	**25,800**	5,160
P1	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707
P2	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707
P3	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707

Based on table 4.1 above, the results of the calculation of stem height using ecoenzyme can be explained. In the table it is known that in the first week stem height shows that there is no real interaction between treatments 1, 2, 3 and 4 on the growth of sunflower sprouts. The highest stem was found in the P0 = (water) treatment with an average of 5.160 and the lowest was found in the P1 = (ecoenzyme + water) (15ml/L) treatment with an average of 3.535, P2 = (ecoenzyme + water) (20ml/L) with an average of 3.535, and P3 = (ecoenzyme + water) (30ml/L) with an average of 3.535. The observation results of stem height in week 2 are presented in Table 4.2 below.

Table 2: Stem Height at Week 2

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	11,2	12	9,7	11	8,3	**52,200**	10,440
P1	16	8,7	11,5	8,7	4,7	**49,600**	9,920
P2	12,7	5	6,3	9,3	13	**46,300**	9,260
P3	16	15	17,5	19	15	**82,500**	16,500

Based on table 4.2 above, the results of the calculation of stem height using ecoenzyme can be explained. In the table it is known that in week 2 stem height shows that there is a real interaction between treatments 1, 2, 3 and 4 on the growth of sunflower sprouts. The highest stem was found in the treatment P3 = (ecoenzyme + water) (30 ml/L) with an average of 16.500 and the lowest was found in the treatment P2 = (ecoenzyme + water) (20 ml/L) with an average of 9.260. The observation results of stem height in week 3 are presented in Table 4.3 below.

Table 3. Stem Height at Week 3

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	15,3	17,8	14	16,7	12,5	**76,300**	15,260
P1	26	15,7	20,3	16,8	10,3	**89,100**	17,820
P2	23,7	13	14,3	16	26,7	**93,700**	18,740
P3	29,3	30	29,9	33,3	34,3	**156,800**	31,360

Based on table 4.3 above, the results of the calculation of stem height using ecoenzyme can be explained. In the table it is known that in week 3 stem height shows that there is a real interaction between treatments 1, 2, 3 and 4 on the growth of sunflower sprouts. The highest stem was found in the P3 = (ecoenzyme + water) (30 ml/L) treatment with an average of 31.360 and the lowest was in the P0 = (water) treatment with an average of 15.260. The observation results of the number of leaves in the week are presented in Table 4.4 below.

Table 4. Number of Leaves in Week 1

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	3	2	2	2	2	**11,000**	2,200
P1	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707
P2	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707
P3	0,707	0,707	0,707	0,707	0,707	**3,535**	0,707

Based on table 4.4 above, the results of the calculation of the number of leaves using ecoenzyme can be explained. The number of leaves in week 1 shows that there is a real interaction between treatments 1, 2, 3 and 4. The most leaves are found in treatment P0 = (water) with an average of 2,200 and the lowest are found in treatment P1 = (ecoenzyme + water) (15 ml / L) with an average of 0.707, P2 = (ecoenzyme + water) (20ml / L) with an average of 0.707, and P3 = (ecoenzyme + water) (30ml / L) with an average of 0.707. The observation results of the number of leaves in the week are presented in Table 4.5 below.

Table 5. Number of Leaves in Week 2

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	4	6	5	5	4	**24,000**	4,800
P1	7	4	5	5	2	**23,000**	4,600
P2	4	1	6	4	6	**21,000**	4,200
P3	4	6	6	8	8	**32,000**	6,400

Based on table 4.5 above, the results of the calculation of the number of stems using ecoenzyme can be explained. The number of leaves in week 2 shows that there is a real interaction between treatments 1, 2, 3 and 4. The most leaves are found in treatment P3 = (ecoenzyme + water) (30 ml/L) with an average of 6,400 and the lowest is found in treatment P2 = (ecoenzyme + water) (20 ml/L) with an average of 4,200. The observation results of the number of leaves in the week are presented in Table 4.6 below.

Table 6: Number of Leaves in Week 3

Treatment	Repeat					Total	Average
	I	II	III	IV	V		
P0	6	6	6	6	5	**29,000**	5,800
P1	7	5	6	5	3	**26,000**	5,200
P2	6	3	6	6	8	**29,000**	5,800
P3	6	8	9	11	10	**44,000**	8,800

Based on table 4.6 above, the results of the calculation of the number of stems using ecoenzyme can be explained. The number of leaves in week 3 shows that there is a real interaction between treatments 1, 2, 3 and 4. The most leaves are found in treatment P3 = (ecoenzyme + water) (30 ml/L) with an average of 8,800 and the lowest is found in treatment P1 = (ecoenzyme + water) (15 ml/L) with an average of 5,200.

Discussion

The results of this test are in accordance with the research of Hanafiah (2010) which shows that ecoenzyme solutions made from organic materials such as fruits tend to produce acidic chemical parameters at low pH levels. Organic acids play a key role in determining acidity. This means that the higher the concentration of organic acids, the lower the pH. The ecoenzyme in this study has a low pH value due to the high content of organic acids such as acetic acid or citric acid (Etienne, Genard, Lobit, Mbeguie-Ambeguie, & Bugaud, 2013).

In addition, the existing enzyme solutions produced with organic materials such as fruit waste or organic solid waste and molasses added as substrates in the fermentation process encourage high TDS factors in ecoenzymes (Selvakumar, 2017).

Table 4.1 shows that in the first week stem height there is no significant interaction between treatments 1, 2, 3, and 4 on the growth of sunflower sprouts. This shows that the provision of P1, P2, and P3 treatments gives less than optimal results on sunflower sprouts. Table 4.2 shows that the provision of ecoenzymes in the second week stem height has a significant interaction between treatments 1, 2, 3, and 4 on sunflower sprouts. This proves that the provision of P1, P2, and P3 treatments provides optimal results in sunflower sprouts. Furthermore, table 4.3 shows that the effect of ecoenzyme on stem height in the third week is quite optimal because there is a significant interaction between treatments 1, 2, 3, and 4 on sunflower sprouts.

Table 4.4 shows that in the number of leaves in the first week there is a significant interaction between treatments 1, 2, 3, and 4. This proves that the implementation of the P0 treatment provides optimal results in sunflower sprouts. Table 4.5 shows that in the number of leaves in the second week there is a significant interaction between treatments 1, 2, 3, and 4. This shows that the implementation of treatments P1, P2, and P3 provides optimal results in sunflower sprouts. Furthermore, table 4.5 shows that the number of leaves in the third week there is a significant interaction between treatments 1, 2, 3, and 4. This proves that the implementation of treatments P1, P2, and P3 provides optimal results in sunflower sprouts.

Based on the discussion above, the implementation of ecoenzymes made from citrus peel waste is proven effective on the growth of sunflower sprouts. The effectiveness of this ecoenzyme is also influenced by fermentation time, where the value of parameters except pH will decrease during the fermentation period due to the degradation of organic matter by microorganisms contained in the enzyme solution (Nazim & Meera, 2013).

Therefore, the pH indicator obtained is higher, since the parameter is analyzed immediately after 3 months of fermentation. In addition, an important influence is the organic matter used for fermentation. Therefore, to better utilize the technology, ecoenzymes are needed in development research by combining different organic materials and monitoring variations in time and operating conditions (Rochyani, Utpalasari, & Dahliana, 2020).

The presence of vitamin C can increase the growth of vegetative parts such as leaves. Vitamin C contained in orange peel pieces is sufficient to encourage vegetative growth, so that the leaves of the plant become wider, greener and of higher quality. Sunflower leaves are the most valuable part of the plant. The main function of vitamin C for plants is to stimulate growth in general, especially in stems, branches and leaves.

CONCLUSION

Orange peel waste as an ecoenzyme liquid has the potential for the growth of sunflower sprouts (Helianthus annus L). The optimal concentration of ecoenzyme in influencing the growth of sunflower sprouts is 30 ml/L which comes from the P3 treatment. The provision of ecoenzyme as a nutrient in each parameter can significantly affect the parameters of stem height and number of leaves of sunflower sprouts. Uneven sun intensity also affects the growth of sunflower sprouts for each treatment. Sunflowers require adequate sun exposure to thrive well when grown in areas that have a climate that tends to be warm or dry. The higher the temperature around the sunflower plant, the more likely it is to grow to a larger size. Donors, resource persons, or parties who have

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