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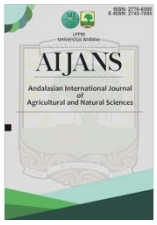

Article

Effect of Mycorrhizae Inoculation and Maggot Compost on Sunflower Development on Marginal Land

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Abstract

The use of inorganic fertilizers for a long time has an adverse impact on soil quality and the environment. For this reason, an agricultural approach that uses potential natural resources is needed. One of them is by applying agriculture in an organic concept that utilizes biological materials such as mycorrhiza and the addition of maggot compost. The purpose of this study was to determine the effect of mycorrhizal inoculation and maggot compost on the development of sunflowers on marginal land. In practice, the study used a randomized block design consisting of two factors, namely mycorrhizal inoculum and maggot compost which was repeated 3 times. The results of the study showed that mycorrhizal inoculation and maggot compost had an influence on the development of sunflowers such as the time of full bloom, ribbon flower diameter, tube flower diameter, number of seeds planted and weight of 100 seeds on marginal land. the higher the dose of mycorrhiza and maggot compost applied, the increase in each parameter observed in sunflower development on marginal land.

INTRODUCTION

Today, most of the practices of modern agricultural systems rely more on the addition of external materials in the form of inorganic fertilizers to maintain or increase the productivity of a plant being cultivated. However, in the long term, the use of inorganic fertilizers has an adverse impact on soil quality and the environment. This is contrary to the basic principles of organic farming which are currently being intensively developed. According to [8], the use of inorganic fertilizers is a way of using limited resources and is contrary to the demand for agricultural products that are residue-free and produced sustainably.

For this reason, an agricultural approach is needed that uses natural resources that have the potential to produce agricultural products that have high nutritional value, quality and profitable yields. One of them is by applying agriculture in an organic concept that utilizes biological materials such as mycorrhiza and the addition of maggot compost. According to [11], mycorrhiza is a useful microorganism that is widely found in nature and agricultural soil and generally colonizes the roots of many plant species which can improve growth, productivity and quality of plants without degrading the quality of the soil ecosystem.

The use of mycorrhiza has been widely used to manipulate marginal lands such as ultisols, dry land, ex-mining land, and sandy land. These lands have various problems such as

low soil fertility, limited water availability, and high soil temperatures. The results showed that the association of mycorrhizae with plant roots plays a role in the flow of photosynthates from the host plant to the fungus and the flow of nutrients and water from the fungus to the host plant, and there is 80% of growth obtaining nutrients through the help of mycorrhiza [12]. [24] added that the phosphatase enzyme activity produced by mycorrhiza functions in releasing P bonds from organic complexes so as to increase P available to plants. In addition, the results of other studies also showed that there was a significant interaction between mycorrhizal inoculation, organic matter, and natural phosphate application on cucumber leaf area [20] Research by [14] reports that mycorrhizae can also be used in rehabilitation of critical lands for food crops, plantations or for reforestation purposes .

In addition to giving mycorrhiza, other efforts need to be made by utilizing maggot compost. This compost is the result of the decomposition of maggots or the larvae of the *Black Soldier Fly* (BSF) [18]. The results showed that the application of maggot compost to long bean plants gave growth results which is better than growth without treatment [9]. The results of the study showed a correlation between the use of mycorrhiza and organic fertilizers in cultivated plants under various conditions . [26] reported the results of a study that there was an increase in mycorrhizal colonization of plant roots due to chicken manure, besides being caused by an increase in soil organic matter and pH, it was also possibly caused by the high P and calcium content in chicken manure. According to [5] that the application of mycorrhiza combined with manure can increase the concentration of N, P, K and soil organic matter content so that it can increase nutrient uptake, growth and plant yields.

The use of organic fertilizers in the form of maggot compost and the addition of mycorrhiza is expected to be able to optimally increase the development of sunflower plants in marginal lands such as coastal areas . This study aims to determine the effect of mycorrhizal inoculum and maggot compost on the development of sunflowers on marginal land.

EXPERIMENTAL SECTION

Time and Place of Research

Research conducted in Muaro Bantiang Ampang Pulai District of Koto XI Tarusan , Pesisir Selatan Regency , West Sumatra Province in August – November 2020.

Tools and materials

This study used tools such as hoes, scrapers, machetes, scissors, digital scales, raffia rope, tape measure, cameras and stationery, while the materials used were sunflower seeds, mycorrhiza, maggot compost, pearl NPK fertilizer and chemical pesticides.

Research design

research design used was factorial randomized block design. The first factor is the mycorrhiza dose, namely B1 = 0 gr/plant, B2 = 5 gr/plant, B3 = 10 gr/plant, and B4 = 15 gr/plant, while the second factor is the dose of maggot compost, namely K1 = control, K2 = 10 gr/plant. plants, K3 = 15 gr/plant and K3 = 20 gr/plant. Each treatment was repeated 3 times. The research data were analyzed using the F test method at 5% level and followed by DMRT at 5% level.

Research Implementation

Sunflowers need to be seeded first. Nursery is done by sowing sunflower seeds in a planting medium mixed with manure: soil (1:1). The new sown seeds can be transplanted after 3 weeks or have 4 leaves. Furthermore, soil processing and application of mycorrhiza and maggot compost are carried out in each planting hole. Then the land is left for 2 weeks

before planting. Planting sunflower seeds is done by planting 1 seed in each planting hole that has been prepared beforehand . For the maintenance carried out includes stitching up to 7 days after planting if there are dead plants, weeding, watering, pest control and fertilization.

Observation Parameters

Parameters for observing the development of sunflower plants included the time of perfect blooming, ribbon flower diameter, tube flower diameter, total seed planting and weight of 100 seeds.

RESULT AND DISCUSSION

Time of Perfect Bloom (HST)

Statistical analysis of data at the time of full bloom showed that the application of mycorrhiza and maggot compost had a significant effect. The higher the dose used, the faster the time for the flower to fully bloom. The mycorrhiza application at a dose of 15 g/plant gave a faster blooming time of 71.25 days after planting. The application of maggot compost is shown in the application of a dose of 15 g / plant, which is 71.92 days after planting. Observational data can be seen in Table 1.

Table 1. The average time of full bloom of sunflowers days after planting

Treatment		Maggot Compost (g/plant)				Average
		0	10	15	20	
mycorrhiza (g/plant)	0	74.33	73.67	73.33	73.00	73.58 [b]
	5	74.33	74.00	72.67	72.67	73.42 [b]
	10	73.00	73.67	71.67	72.67	72.75 [ab]
	15	72.67	71.33	70.00	71.00	71.25 [a]
Average		73.58 [b]	73.16 [b]	71.92 [a]	72.34 [a]	

The conditions in Table 1 above show that the presence of mycorrhizae in the soil is able to provide soil conditions that are more favorable for plant growth and development. The presence of maggot compost is able to meet the nutrient needs of the sunflower plant with the help of mycorrhizae so that the development process can be accelerated and accelerated. [14], explained that mycorrhizae can be in symbiosis with plant roots and are able to increase the uptake of nutrients N, P, and K and increase the efficiency of groundwater use, increase the osmotic stress value of plant cells in soils with relatively low water content. , so that plants can sustain their lives and be able to increase the rate of vegetative growth and plant production. Mycorrhiza has the ability to associate with almost 90% of plant species and helps in increasing the efficiency of absorption of nutrients (especially phosphorus) on marginal land [23]. In addition, the results of research on giving mycorrhizae to tomato plants showed that there was an increase in the number of flower tomatoes/plants on average 16.5 buds compared to no mycorrhizae which only amounted to 14 buds [11].

Ribbon Flower Diameter(mm)

The application of mycorrhiza and maggot compost showed a significant effect on the diameter of sunflower ribbon flowers on marginal land on the coast. The diameter of sunflower ribbon flowers ranged from the smallest, namely 14.91 mm at no treatment to the widest, namely 16.15 mm at a maggot dose of 15 g/plant and mycorrhiza at a dose of 15 g/plant. Observational data can be seen in Table 2.

Table 2. The average diameter of sunflower ribbon flowers at the age of 7 weeks after planting in coastal areas

Treatment		Maggot Compost (g/plant) 0	10	15	20	Average
mycorrhiza (g/plant)	0	14.91	15.00	15.25	15.22	15.10 [a]
	5	15.22	15.30	15.40	15.40	15.33 [a]
	10	15.67	15.67	15.66	15.87	15.72 [a]
	15	15.90	15.85	16.15	15.75	15.91 [a]
Average		15.43 [a]	15.46 [a]	15.62 [a]	15.56 [a]	

In Table 2 above it can be seen that the application of mycorrhiza and maggot compost can increase the diameter of the ribbon flowers, although not too big. This is probably due to the characteristics of the sunflower varieties used. These characters will be optimal if met with a supportive environment. According to [25] that plant performance is influenced by genetic and environmental factors and the interaction between the two. These conditions indicate that the presence of mycorrhiza and maggot compost play a role in adjusting environmental conditions to suit the development of sunflowers. The results of research by [1] showed mixed results on sunflower productivity after inoculation with mycorrhiza and different fertilization treatments. In addition, the metabolic processes and increased vegetative growth and yield of sunflower depend on N supply [7][15].

Tube Flower Diameter(mm)

The application of mycorrhiza and maggot compost to sunflowers on coastal marginal land has shown significant results on the diameter of sunflower tube flowers based on statistical data. In Table 3 it can be seen that the diameter of the sunflower tube flower ranges from 175.66 mm to 178.97 mm.

Table 3. The average diameter of sunflower tube flowers at the age of 7 weeks after planting in coastal areas

Treatment		Maggot Compost (gr/tan) 0	10	15	20	Average
mycorrhiza (gr/plant)	0	175.76	176.20	177.15	177.37	176.62 [a]
	5	175.85	176.35	177.65	177.55	176.85 [a]
	10	177.58	177.88	178.80	178.80	178.27 [b]
	15	177.85	178.15	178.88	178.97	178.46 [b]
Average		176.76 [a]	177.15 [ab]	178.12 [b]	178.17 [b]	

The increase in the diameter of the sunflower tube flower as shown in Table 3 above shows that the application of mycorrhiza and maggot compost is able to play a role in providing and helping to optimize nutrient absorption in supporting the development of sunflower plants in coastal land which is known as marginal land. The increase in the diameter of the sunflower tube flower is directly proportional to the increase in the dose of mycorrhiza and maggot compost given. This is in line with the research of [1] that the application of mycorrhiza can increase the diameter of the flower tubes of sunflower plants. This condition is also supported by the addition of fertilization which has a higher concentration of N. [19] reported that higher N levels increased the stem height and diameter of sunflowers. In another study it was stated that the increase in plant height and flower tube diameter might also be affected through mycorrhizal colonization which increases the uptake of other nutrients such as Boron. According to [3] that sunflowers are very sensitive to low Boron supply because it can inhibit vegetative growth and development of reproductive organs.

Total Seeds Planted (seeds)

Based on statistical data, it was found that the application of mycorrhiza and maggot compost showed a significant effect on total sunflower seeds planted on the coast. Total seed planting increased with each additional dose of mycorrhiza and maggot compost. Observational data can be seen in Table 4.

Table 4. Total sunflower seeds planted

Treatment		Maggot Compost (g/plant)				Average
		0	10	15	20	
mycorrhiza (g/plant)	0	1075	1091.72	1110.5	1124.67	1100.473 [a]
	5	1095	1105.67	1096.33	1118.25	1103.813 [a]
	10	1107	1112.85	1112	1130.67	1115.63 [b]
	15	1121	1150.33	1175.67	1184.67	1157.91 [b]
Average		1099.5 [a]	1115.14 [b]	1123.62	1139.56 [b]	

In Table 4 above, it can be seen that the application of mycorrhizal and maggot compost affected total sunflower seed planting with the highest average total seeds found in the mycorrhizal application at a dose of 15g/plant, namely 1157.91 seeds, while in the application of maggot compost, it was found at a dose of 20g/plant, namely 1139.56 seeds. This is due to the role of mycorrhiza which is able to provide adequate sources of nutrients for sunflower plants, in addition to conditioning the environment, especially the soil so that it is able to store water longer and influence the roots to absorb nutrients more optimally. [21] states that plants that have symbiosis with mycorrhizae tend to show good growth and development when compared to plants that do not have symbiosis with mycorrhizae at all. In the application study, the dose of mycorrhizal administration equivalent to 180 g/plot (1.5 m2) had a significant effect with an increase in peanut seed production of 8.7%, around 0.18 tons/ha compared to seed production with the control treatment [16].

Same condition is also affected by the addition of maggot compost so that the nutrients in the sandy soil are available for sunflower plants. The presence of mycorrhiza helps sunflower plants in maximizing the absorption of nutrient sources from maggot compost so that plant development becomes more optimal during its life cycle. [10] stated that the nutrients in the soil without the application of chicken manure could not meet the nutrient needs of shallot plants because there was no basic fertilizer, which caused the physical properties of the soil to be quite hard and inhibited plant growth and development. [20] reported the results of their research that there was a significant interaction between mycorrhizal inoculation, organic matter, and natural phosphate application on cucumber leaf area.

Weight of 100 Seeds (g)

Statistical analysis showed that the application of mycorrhiza and maggot compost had a significant effect on the weight of 100 sunflower seeds. The weight of 100 sunflower seeds ranged from 3.45 g to 3.86 g with the average weight of the highest 100 seeds being mycorrhizal applications at a dose of 20 g/plant and maggot compost at a dose of 20 g/plant . Observational data can be seen in Table 5.

Table 5. Weight of 100 sunflower seeds planted on coastal land

Treatment	Maggot Compost (gr/tan)	Average

		0	10	15	20	
mycorrhiza (gr/plant)	0	3.45	3.52	3.64	3.64	3.56
	5	3.53	3.61	3.78	3.77	3.67
	10	3.68	3.73	3.78	3.81	3.75
	15	3.75	3.78	3.83	3.86	3.81
Average		3.60	3.66	3.76	3.77	

The application of mycorrhiza and maggot compost as shown in Table 5 above shows that the higher the dose applied affects the weight of the 100 sunflower seeds produced. The increase in the weight of 100 seeds is of course the effect of various improvements in soil conditions due to the application of mycorrhiza which theoretically expands the coverage of plant roots so that they are able to obtain more nutrients and water for plant growth when compared to conditions in plants without application. According to [2] stated that mycorrhiza plays an important role in plant growth by increasing the absorption of nutrients by expanding the absorption area.

If you look at the data above, the increase in weight of the 100 seeds produced was not too high between the treatment doses given both mycorrhiza and maggot compost. This depends on the ability of the planted sunflower varieties to interact with the planting environmental conditions. The nutrients provided are sometimes sufficient, but because of the appearance of the variety itself, the results obtained are also affected. [17] and [22] found results that there is a relationship between seed weight and flower tube diameter of planted sunflowers. In addition, seed size is a character related to yield [13].

CONCLUSION

Based on the results and discussion above, it can be concluded that mycorrhizal inoculation and maggot compost have an influence on the development of sunflowers such as the time of full bloom, ribbon flower diameter, tube flower diameter, number of seeds planted and weight of 100 seeds on marginal land. the higher the dose of mycorrhiza and maggot compost applied, the increase in each parameter observed in sunflower development on marginal land

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