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Growth of Eggplant in Early Generative Stage to Application of Ameliorants and Mycorrhizal Biofertilizer During Water Saturated Stress

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Abstract
Eggplant cultivation can be done in various types of land, because eggplant is a plant that is easy to adapt to the soil environment. One of the lands that can be used for eggplant cultivation is lebak swamp land by applying ameliorants and mycorrhizal biofertilizers. The purpose of the study was to determine the growth response and high level of resistance of purple eggplant plants by giving a combination application of ameliorants and mycorrhizal biofertilizers in several water-saturated conditions in the early generative phase. The research was conducted in the Laboratory and Experimental Garden of the Agrotechnology Study Program, Faculty of Plant and Animal Sciences, Bina Insan University, from July to November 2024. The research design used was a Factorial Completely Randomized Design (CRD) with two treatment factors, the first factor was water saturation conditions (S) and the second factor was the combination of ameliorants and mycorrhizal biofertilizers (M). The results showed that the treatment of water saturation conditions had a significant effect on plant height, stem diameter, number of leaves, root length and dry weight of eggplant plants, while the treatment of ameliorants and mycorrhizal biofertilizers only had a significant effect on the number of leaves. Water saturation conditions and the combination of ameliorants and mycorrhizal biofertilizers showed very significantly different interaction results only on plant height and number of leaves.

Keywords: Ameliorant, Eggplant, Micoriza, Water Excess

1. INTRODUCTION

Lebak swamp land is inland swamp land that has relatively concave topographic conditions and water cannot flow out. Every year this land experiences inundation for at least three months with a minimum inundation height of 50 cm. Lebak swamp is a degradation area with the main source of water coming from rainfall, and the receding of water only relies on the percolation process and evaporation in the dry season (Alwi, 2017). Lebak swamp land is characterized by acidic pH conditions, ranging from 4 to 4.5, has a high content of clay and dust fractions, and a very low sand fraction. Lebak swamp land also has a higher organic matter content (carbon percentage) in mid-lebak and deep lebak compared to shallow lebak (Kodir et al., 2016).

The potential area of swamp land in South Sumatra reaches 3.05 million ha consisting of 1.36 million ha of lebak swamp land and 1.69 million ha of tidal swamp land (BSIP, 2023). One of the crops that can be planted on lebak swamp land is purple eggplant. Purple eggplant is an agricultural commodity and one type of vegetable that is favored by the community because in addition to having a good taste, it also contains many vitamins and

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nutrients such as vitamin A, vitamin B, vitamin C. potassium, phosphorus, iron, protein, fat, and carbohydrates (Sihotang et al., 2023). One of the efforts needed to increase the productivity of lebak swamp land is by applying ameliorants and mycorrhizal biofertilizers.

The utilization of organic ameliorants in soils with limited nutrient availability is very necessary. Organic ameliorants can consist of various mixtures of organic materials available in the agricultural environment such as manure, husk charcoal (biochar), green fertilizer etc. Ameliorants are materials added to the soil so that they can increase soil fertility through improving the physical and chemical conditions of the soil (Adriany et al., 2016). One alternative to meet the needs of nutrients for plants is by using mycorrhizal biofertilizers.

Mycorrhiza has potential as a biofertilizer because it can facilitate nutrient absorption in the soil. As a result, it can increase plant growth, biological barriers to root pathogen infection, increase water availability for plants and increase growth-promoting hormones. In addition, Mycorrhiza is also able to adapt to extreme environments, especially on marginal soils such as acidic dry soils (Iffah, 2020).

The utilization of organic ameliorants in soils with limited nutrient availability is very necessary. Organic ameliorants can consist of various mixtures of organic materials available in the agricultural environment such as manure, husk charcoal (biochar), green fertilizer etc. Ameliorants are materials added to the soil so that they can increase soil fertility through improving the physical and chemical conditions of the soil (Adriany et al., 2016).

This study aims to determine whether purple eggplant (Solanum melongena L.) plants with the application of mycorrhizal biofertilizers and ameliorants have a high level of resistance to several water-saturated conditions in the early generative phase, so that later it can be one of the recommended solutions for lebak swamp land farmers in the practice of purple eggplant cultivation in water-saturated conditions.

This study used a factorial completely randomized design (CRD) with 2 factors. The first factor is water saturation (S) with 4 levels of treatment, while the second factor is mycorrhiza and ameliorant (M) with 4 levels of treatment, so there are 16 treatment combinations. Each treatment consisted of 6 replicates so that the total number of plants obtained was 96 plants.

2. LITERATURE REVIEW

According to Nafiah and Prasetya (2019), the provision of consortium biological fertilizers combined with Arbuscular Mycorrhizal fungi was able to increase the height of corn plants at 6-8 weeks after planting by 42% and 34% compared to the control treatment.

According to (Sukayat et al., 2019), this organic fertilizer is a source of nutrients and plays a role in maintaining the water and air system of the planting media.

The results showed that the application of ameliorants and mycorrhizal biofertilizers was able to increase growth by 25%-43%, analysis of variance showed that mycorrhizal and ameliorant treatments had a significant effect on plant height, number of leaves, total leaf area, leaf area index, number of fruits, fruit weight, on the productivity of cayenne pepper plants, The results of this study are also supported by research (Singh et al., 2018).

According to the results of research (Mei et al., 2023), stated that eggplant plants are able to adapt to shallow water table conditions and inundation by forming aerenchymal networks in the root organs and accumulating prolina in the leaf organs so that eggplants include fruit vegetable crops that are quite high tolerance to water table 3 cm below ground level and inundation.

3. METHODS

Place and Time

This research was conducted in the laboratory and experimental garden of Agrotechnology Study Program, Faculty of Plant and Animal Sciences, Bina Insan University Lubuklinggau. This research was conducted from July to November 2024.

Materials and Tools

The materials used were 35 cm x 35 cm polybags, MZ2000 mycorrhizal biofertilizer, top soil, ameliorants (rice husk biochar and goat manure), purple eggplant seeds Yuvita F1 variety, Bayfolan foliar fertilizer, NPK Mutiara fertilizer (16:16:16), infarm liquid organic fertilizer, furadan insecticide, antracol fungicide, garlic vegetable pesticide, Coco Peat and Vermi Compost. The tools used were tubs/containers, seedling trays, vectors, meters, digital cameras, digital scales, and ovens.

Research Methods

This study used a Factorial Completely Randomized Design (CRD) with 2 factors. The first factor was water saturation (S) with 4 treatment levels consisting of field capacity (S0), low shallow water table (10-15 cm below the soil surface) (S1), high shallow water table (5 cm below the soil surface) (S2), and total water saturation/waterlogging (S3), while the second factor is the combination of mycorrhizal biofertilizer + ameliorant (goat manure 200 g/plant + rice husk biochar 80 g/plant) (M) with 4 treatment levels consisting of mycorrhizal biofertilizer 10 g/plant (M0), mycorrhizal biofertilizer 15 g/plant (M1), ameliorant + mycorrhizal biofertilizer 10 g/plant (M2), ameliorant + mycorrhizal biofertilizer

15 g/plant (M3), so there are 16 treatment combinations. Each treatment consisted of 6 replicates so that 96 plants were obtained. The treatment combinations are as follows.

Data Analysis

Data were analyzed by Analysis of Variance (ANOVA) using the Statistical Analysis System (SAS) program, then further tests were carried out using the honest real difference test (BNJ) at the 5% level if the results showed significantly different or very significantly different results.

4. RESULTS

Analysis of Variance Analysis of Variance (ANOVA) Plant Height, Stem Diameter, Number of Leaves and Root Length of Eggplant Plants

Based on the results of the research that has been carried out, the results of the analysis of variance show that the treatment of water-saturated conditions has a significant effect on the results of plant height, stem diameter, number of leaves, and root length while the treatment of ameliorant and mycorrhizal biofertilizer combination application only has a significant effect on the number of leaves. Water saturation conditions and the application of ameliorants and mycorrhizal biofertilizers showed significantly different interaction results on plant height, and number of leaves, on the observed growth variables of eggplant plants (Table 1).

Table 1: Recapitulation of ANOVA variance results of plant height, stem diameter, number of leaves and root length of eggplant plants.

Observation Variables	Water-Saturated Condition (S)	Combination of Mycorrhizal Biofertilizer and Ameliorant (M)	S X M	KK (%)
Plant Height	323.076**	12.009tn	66.504**	16,598
Stem Diameter	23.188**	5.968tn	4.085tn	12,081
Number of Leaves	192.743**	33.687**	17.668**	18,121
Root Length	1458.014**	129.924tn	53.956tn	19,482

Notes: ** = significantly different (P<0.01), tn = not significantly different, KK = coefficient of variation

BNJ Further Test (@= 0.05) on Plant Height Result

The results showed that the highest to lowest plant height in the water-saturated condition treatment was S1, S0, S2 and S3, while the highest to lowest plant height results in the combined application of ameliorants and mycorrhizal biofertilizers were M0, M1, M2 and M3.

Table 2: Plant height of eggplant plants under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

1	Plant Height (cm)				Average
	S0	S1	S2	S3	
M0	30,4	32,3	32,8	20,3	28,93 a
M1	29,9	41,0	21,5	17,4	28,75 a
M2	33,0	32,9	25,0	24,1	27,46 a
M3	30,0	27,9	23,7	25,8	26,86 a
Average	30,82 ab	33,53 a	25,75 bc	21,90 c	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

The plant height of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the plant height of the M0 treatment was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on plant height (Table 2).

BNJ Further Test (@= 0.05) on Plant stem diameter

The results showed that the stem diameter from highest to lowest in the treatment of water-saturated conditions was S0, S1, S2 and S3, while the results of stem diameter from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were M0, M1, M2 and M3. The stem diameter of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the stem diameter of the M0 treatment was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on stem diameter (Table 3).

Table 3: Stem Diameter of eggplant plants under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

Treatment	Stem Diameter (mm)				Average
	S0	S1	S2	S3	
M0	14,0	15,0	13,4	13,0	14,75 a
M1	14,5	15,4	13,0	9,3	13,83 a
M2	15,5	15,1	15,0	13,5	13,73 a
M3	16,2	13,5	13,2	12,1	13,04 a
Average	15,02 a	14,74 a	13,64 ab	11,95 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

BNJ Further Test (@= 0.05) on Number of Leaves

The results showed that the number of leaves from the highest to the lowest in the treatment of water-saturated conditions were S1, S0, S2 and S3, while the results of the number of leaves from the highest to the lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were M2, M3, M0 and M1. The number of leaves of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the number of leaves of the M2 treatment was not significantly different from M3, but significantly different from M0 and M1. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on the number of leaves (Table 4).

Table 4: Number of leaves of eggplant plants under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

Treatment	Number of Leaves (strands)				Average
	S0	S1	S2	S3	
M0	13,7	13,0	11,3	2,7	10,16 bc
M1	12,3	15,7	8,3	0,0	9,08 c
M2	14,7	14,3	12,7	9,7	12,83 a
M3	14,3	12,7	11,3	9,0	11,83 ab
Average	13,75 a	13,91 a	10,91 b	5,33 c	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

BNJ Further Test (@= 0.05) Root Length

The results showed that the root length from highest to lowest in the treatment of water-saturated conditions was found in S0, S1, S2 and S3, while the results of root length from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were found in M3, M2, M0 and M1. The root length of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the root length of the M0 treatment was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on root length (Table 5).

Table 5: Root length of eggplant plants under multiple water-saturated conditions to combined application of ameliorants and mycorrhizal biofertilizers

Treatment	Root length (cm)				Average
	S0	S1	S2	S3	
M0	45,2	44,0	32,5	20,6	35,57 a
M1	44,9	41,9	30,8	10,5	32,03 a
M2	40,2	43,9	40,2	26,2	37,64 a
M3	47,9	43,1	43,1	24,9	39,75 a
Average	44,57 a	43,21 ab	36,66 b	20,55 c	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

Analysis of Variance (ANOVA) Biomass Dry Weight of Roots, Stems, Leaves and Flowers of Eggplant Plants

Based on the results of the research that has been done, the results of the analysis of variance show that the treatment of water-saturated conditions has a significant effect on the results of dry weight of roots, leaves and total dry weight while the treatment of combined application of ameliorants and mycorrhizal biofertilizers is not significantly different. Water saturation conditions and the application of ameliorants and mycorrhizal biofertilizers showed that the interaction results were not significantly different in all observed growth variables of eggplant plants (Table 6).

Table 6: Recapitulation of ANOVA variance results of dry weight of roots, stems, leaves, and flowers of eggplant plants

Observation Variables	Water-Saturated Condition (S)	Combination of Mycorrhizal Biofertilizer and Ameliorant (M)	S X M	KK (%)
Roots	198.612**	4.547tn	12.020tn	38,534
Stem	557.446**	27.484tn	9.109tn	26,540
Leaves	168.217**	2.483tn	8.358tn	25,338
Flower	1.049**	0.099tn	0.026tn	54,974
Total	2633.641**	78.936tn	57.529tn	22,718

Description: * = significantly different, ** = significantly different, tn = not significantly different, KK = coefficient of variation

BNJ Further Test (@= 0.05) Root Dry Weight

The results showed the highest to lowest root dry weight in the treatment of water-saturated conditions were S1, S0, S2 and S3, while the results of root dry weight from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were M2, M3, M0 and M1.

Table 7: Root dry weight of eggplant plants under multiple water-saturated conditions to combined application of ameliorants and mycorrhizal biofertilizers

Treatment	Root Dry Weight (g)				Average
	S0	S1	S2	S3	
M0	9,5	14,3	5,5	1,0	7,55 a
M1	11,3	10,1	4,0	0,5	6,46 a
M2	7,7	11,8	6,0	5,5	7,74 a
M3	11,3	10,1	5,5	4,0	7,74 a
Average	9,93 a	11,54 a	5,22 b	2,78 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

The root dry weight of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the root dry weight of the M0 treatment was not significantly different from M1, M2 and M3. The interaction of water-saturated condition treatment and the application of a combination of ameliorants and mycorrhizal biofertilizers showed significantly different results on root dry weight (Table 7).

BNJ Further Test (@= 0.05) Stem Dry Weight

The results showed that the highest to lowest stem dry weight in the treatment of water-saturated conditions was found in S0, S1, S2 and S3, while the results of leaf dry weight from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were found in M2, M3, M0 and M1. The dry weight of S0 plant stems showed results that were not significantly different from S1, but significantly different from S2 and S3, while the dry weight of M0 treatment roots was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on the dry weight of plant stems (Table 8).

Table 8: Stem dry weight of eggplant plants under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

Treatment	Stem Dry Weight (g)				Average
	S0	S1	S2	S3	
M0	17,5	20,5	10,0	5,3	13,31 a
M1	18,6	17,4	5,7	2,3	11,00 a
M2	20,0	20,8	11	6,3	14,52 a
M3	20,1	16,4	10	8,4	13,74 a
Average	19,03 a	18,78 a	9,19 b	5,57 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

BNJ Further Test (@= 0.05) Leaf Dry Weight

The results showed that the highest to lowest leaf dry weight in the treatment of water-saturated conditions was found in S0, S1, S2 and S3, while the results of leaf dry weight from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were found in M2, M0, M3 and M1. The dry weight of S0 plant leaves showed results that were not significantly different from S1, but significantly different from S2 and S3, while the dry weight of M0 treatment leaves was not significantly different from M1, M2 and M3. The interaction between the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed significantly different results on the dry weight of plant leaves (Table 9).

Table 9: Leaf dry weight of eggplant plants under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

Treatment	Leaf Dry Weight (g)				Average
	S0	S1	S2	S3	
M0	13,5	10,6	9,0	6,5	9,91 a
M1	14,1	13,7	5,0	3,2	8,97 a
M2	12,2	13,4	7,6	6,6	9,93 a
M3	13,8	10,7	6,7	6,5	9,42 a
Average	13,39 a	12,07 a	7,08 b	5,70 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

BNJ Further Test (@= 0.05) Flower Dry Weight

The results showed that the highest to lowest dry weight of plant flowers in the treatment of water-saturated conditions was found in S0, S1, S2, and S3, while the highest to lowest dry weight of plant flowers in the treatment of combined application of ameliorants and mycorrhizal biofertilizers was found in M1, M2, and M0. The dry weight of S0 plant flowers showed results that were not significantly different from S1, but significantly different from S2 and S3, while the dry weight of M0 treatment flowers was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other on flower dry weight (Table 10).

Table 10: Flower dry weight of eggplant under some water-saturated conditions to the application of a combination of ameliorants and mycorrhizal biofertilizers

Treatment	Flower Dry Weight (g)				Average
	S0	S1	S2	S3	
M0	0,5	0,6	0,2	0,0	0,30 a
M1	0,6	0,6	0,2	0,0	0,43 a
M2	0,9	0,6	0,4	0,1	0,51 a
M3	0,8	0,5	0,2	0,2	0,42 a
Average	0,71 a	0,56 a	0,23 b	0,06 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

BNJ Further Test (@= 0.05) Total Dry Weight

The results showed that the total dry weight from highest to lowest in the treatment of water-saturated conditions was found in S0, S1, S2 and S3, while the results of total dry weight from highest to lowest in the treatment of combined application of ameliorants and mycorrhizal biofertilizers were found in M2, M3, M0 and M1. The total dry weight of the S0 treatment showed results that were not significantly different from S1, but significantly different from S2 and S3, while the total dry weight of the M0 treatment was not significantly different from M1, M2 and M3. The interaction of the treatment of water-saturated conditions and the application of a combination of ameliorants and mycorrhizal biofertilizers showed results that were not significantly different from each other in total dry weight (Table 11).

Table 11: Total dry weight of eggplant plants under multiple water-saturated conditions to combined application of ameliorants and mycorrhizal biofertilizers

Treatment	Total Dry Weight (g)				Average
	S0	S1	S2	S3	
M0	40.9	45.9	24.7	12.9	31,09 a
M1	44.6	41.7	14.8	6.0	26,78 a
M2	40.7	46.6	25.0	18.5	32,70 a
M3	46.1	37.7	22.5	19.1	31,34 a
Average	43,07 a	42,97 a	21,74 b	14,13 b	(-)

Notes: Numbers followed by the same letter indicate not significantly different based on BNJ honestly significant difference test (α = 0.05), the sign (-) indicates no interaction between treatment combinations. S0 = field capacity, S1 = low shallow water table, S2 = high shallow water table, and S3 = total water saturation/waterlogging. M0 = mycorrhizal biofertilizer 10 g/plant, M1 = mycorrhizal biofertilizer 15 g/plant, M2 = ameliorant + mycorrhizal biofertilizer 10 g/plant, and M3 = ameliorant + mycorrhizal biofertilizer 15 g/plant.

5. DISCUSSION

According to previous research, a significant effect was seen in the number of leaves of chili plants which decreased both after exposure to shallow groundwater (MATD) and after recovery was carried out for seven days (Siaga *et al*., 2024). The results of the analysis of variance showed that in water-saturated conditions had a very significant effect on all parameters observed. According to Ramadhani (2023) various factors such as soil texture, initial soil water content and soil surface depth affect soil water content at field capacity. This is in line with research (Sepwanti et al., 2016) that the high yield of a variety because the variety has been able to adapt to its environment. So, genetically there are varieties that affect plant growth, but only succeed if they interact with the right environment. Under waterlogging stress, the number of plant leaves decreased due to environmental and internal factors (Siaga et al., 2019).

Ameliorant treatment and mycorrhizal biofertilizer actually showed a significant effect on the number of leaves parameter. Leaves are the main photosynthetic producer organ, because of its function as a receiver of light captured by chlorophyll. If the leaves grow well, the light received by the leaves will also affect the absorption of nutrients in plants, especially N which is the main nutrient element that makes up chlorophyll (Nugroho, 2015). Based on the results of research by Adam et al. (2011) stated that the optimum dose cannot be determined by the number of leaves because genetic factors determine the number of leaves more than environmental factors.

The results of the research by Lombantoruan et al. (2021) showed that the results of the research on the application of biological fertilizers were able to increase the average observation of plant height, stem diameter and root length compared to the control. The highest average results were shown by the application of Mikoriza + Petrobio biofertilizer (H1). Petrobio contains microorganisms that can increase soil fertility. The microorganisms contained in petrobio biofertilizer are Pantoea dispersa, Azospirillum sp, Aspergillus niger, Penicillium oxalicum, Streptomyces sp. The results of the analysis are inversely proportional to the results of Siaga's research (2024), which states that the number of leaves of chili plants shows that in shallow water table conditions, mycorrhiza treatment is not significantly different from the number of leaves of chili plants.

Excess water affected the dry weight biomass of plants in this study, including roots, leaves and total dry weight. The results of this study dry weight biomass is a measure of the total mass or weight of plants after removing the water content. Flooded conditions generally result in a decrease in plant dry weight (Kaur et al., 2020), According to Liu's research (2014) flooded conditions result in root damage, decreased absorption of soil water and nutrients, CO_2 fixation, photosynthesis rate resulting in decreased accumulation in dry weight biomass.

Excess water conditions can lead to a decrease in soil microbial activity that normally contributes to plant health and nutrient cycling. Hormones such as auxin, cytokinin and gibberellin have important roles in flower formation and development. Stressful conditions can alter the ratio of these hormones, which can affect flower formation and differentiation.

6. CONCLUSION

Based on the results of the research that has been done, it can be concluded that water-saturated conditions provide a growth response that significantly affects the results of plant height, stem diameter, number of leaves, root length, and dry weight of eggplant plants, while the combination treatment of ameliorant and mycorrhizal biofertilizer provides a growth response that significantly affects the number of leaves of eggplant plants. Water-saturated conditions and the combination of ameliorants and mycorrhizal biofertilizers showed significantly different interaction results on plant height and number of leaves, but not significantly different on dry weight on all observed growth variables of eggplant plants.

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