The Effect of Arbuscular Mycorrhyza Inoculation and SP 36 Fertilizer on the Growth of Palm Oil (*Elaeis Guineensis* Jacq.) Seedling DxP PPKS 540 Variety Grown in Pre Nursery Phase

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Received:- 20 July 2022/ Revised:- 05 August 2022/ Accepted:- 12 August 2022/ Published: 31-08-2022
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Abstract**—***The aims of the study were to determine the effect of arbuscular mycorrhizal inoculation and SP-36 fertilizer and their interaction on the growth and yield of oil palm seedlings of the DxP PPKS 540 variety and to obtain the appropriate dose of mycorrhizal biofertilizer and SP-36 fertilizer for the growth of oil palm seedlings at the pre-nursery stage.The research was carried out from April 2020 to August 2020.The place of research was held on Jl. Rapak Indah, Karang Asam Ilir urban Village, Sungai Kunjang sub District, Samarinda City, East Kalimantan Province.The materials used in this study were DxP PPKS 540, Fungi Mycorrhizal, SP 36 Fertilizer, Dithane M-45, polybag size 22x14 cm and paranet.The tools used in this study were arco carts, soil pH measuring instruments, hoes, soil loosening tools, writing instruments, analytics, and gembor.The study used a completely randomized design (CRD) in a 5x4 factorial experiment, with two treatment factors and repeated 4 times.Mycorrhizal dose factor (M) which consists of 5 levels, namely: no mycorrhizal application or control (m_0); 2.5 g polybag^{-1} (m_1); 5.0 g polybag^{-1} (m_2); 7.5 g polybag-1 (m_3) and 10.0 g polybag^{-1} (m_4) Dosage factor SP 36 (P) consisting of 4 levels, namely: no SP 36 fertilizer application of control (p_0); 1.0 g polybag^{-1} (p_1); 1.5 g polybag^{-1} (p_2); and 2.0 g polybag^{-1} (p_3).Research activities, namely: preparation of planting media, treatment of microzia, preparation of sprouts, planting of seedling, treatment of SP-36 fertilizer, maintenance of seedlings (watering, weeding, and loosening of planting media), and data collection.Data collection is analysis of soil chemical properties in the laboratory, seedling height, stem diameter, number of leaves at aged 1, 2, 3 months after planting and root length at 4 months after planting.Data analysis was carried out by analysis of variance, if the results of variance were significantly different (F-count > F-table 5%) or very significantly different (F-count > F-table 1%), then a further test was carried out with the Least Significant Difference test at 5% level.The results showed that (1) Arbuscular mycorrhizal application had no significant effect on the growth in height, stem diameter, number of seedling leaves at the age of 1, 2, and 3 months after planting, and root length of seedlings at 4 months after planting;(2) application of SP-36 fertilizer had a significant to very significant effect on the height growth at 1, 2, and 3 months after planting, seedling diameter at 1 month after planting, number of leaves at 1 and 3 months after planting, and root length. seedlings at the age of 4 months after planting.Application of SP-36 fertilizer at a dose of 1.5 – 2.0 g plant^{-1} tends to inhibit the growth of oil palm seedlings in the pre-nursery phase;and (3) there was no interaction between mycorrhizal treatment and SP-36 fertilizer treatment on the growth of oil palm seedlings in the pre-nursery phase.*

Keywords— Arbuscular mycorrhizae, SP-36 Fertilizer, Pre Nursery, Oil Palm Seedling.

I. INTRODUCTION

Palm oil is a strategic commodity that is very important as a source of foreign exchange, a source of community livelihood and a profitable commodity for businessmen and smallholders. Palm oil is a very sensitive commodity, palm oil is the most efficient oil-producing crop today. Palm oil production can reach 4 tons ha^{-1} $year^{-1}$, much larger than soybean oil which only produces 0.6 tons ha^{-1} $year^{-1}$ [1].

The success of CPO production is largely determined by the use of certified superior seedlings, as well as the quality (type of seedling and growth rate) and quantity of oil palm seedling.Seedling quality also determines whether oil palm plants can be harvested starting at the age of 30 months in the field.It is influenced, among others by: (1) varieties and sources of seedling or genetic potential; (2) the process of nursery or technical culture in planting and maintaining seedlings; (3) seed selection; and (4) seedling age at the time of planting in the field [2]

Nurseries are a crucial first step for the success of oil palm plantations.Nurseries aim to provide good and healthy seeds in sufficient quantities.In oil palm cultivation, there are two nursery systems, namely single-stage nurseries and two-stage nurseries.What is meant by "double stage" nursery is that the seedlings are carried out in small polybags or in the pre-nursery stage until the seedlings are 3 months old.After the seedlings are 3 months old, the seedlings are transferred to large polybags or the main nursery stage until the seedlings are ready to be planted in the field when they are 12 months old [3].

Success in pre-nursery is strongly influenced by fertile soil conditions and maintenance. Efforts to improve the level of soil fertility is the provision of fertilizers.There are two types of fertilizers that are currently widely used, namely inorganic fertilizers (chemical) and organic fertilizers.Chemical fertilizers can increase soil productivity in a very short time but cause damage to soil structure [4].Organic fertilizers have the advantage of releasing nutrients slowly so that they have a residual effect in the soil and are beneficial for plants [5].One of the organic fertilizers is biological fertilizer.Biological fertilizers, in this case mycorrhizae, are fungi that live in symbiosis with plant roots.Some of the benefits of mycorrhizae are: increasing the absorption of N, P, K, Ca some micro nutrients; increase plant resistance to drought, control root pathogen infection, produce growth-stimulating compounds, stimulate the activity of several beneficial organisms (Rhizobium, Frankia and phosphorus-fixing bacteria); improve soil structure and aggregation; and helps the mineral cycle [6].Arbuscular mycorrhizal fungi are a form of mutualism symbiosis that occurs between plant roots and fungi.Currently, it is known that almost 80% of plants are symbiotic with arbuscular mycorrhizal fungi [7].

In addition to the use of mycorrhizae, to stimulate seedling growth, SP-36 fertilizer can also be applied.This fertilizer contains high levels of phosphorus (P) and dissolves faster than DSP and TSP fertilizers.

II. RESEARCH METHODS

2.1 Time and place

The research was conducted from April 2020 to August 2020.The research site is on Jl. Rapak Indah, Karang Asam Ilir urban Village, Sungai Kunjang sub District, Samarinda City, East Kalimantan Province.

2.2 Materials and tools

The materials used in this study were DxP PPKS 540, Fungi Mycorrhizal, SP 36 Fertilizer, Dithane M-45, polybag size 22x14 cm and paranet.The tools used in this study were arco carts, soil pH measuring instruments, hoes, soil loosening tools, writing instruments, analytical balances, and water sprayer.

2.3 Research design

The study used a completely randomized design (CRD) in a 5x4 factorial experiment, repeated 4 times.The first factor is the mycorrhizal dose (M), which consists of 5 levels, namely: without mycorrhizae (m_0);2,5 g $polybag^{-1}$ (m_1);5,0 g $polybag^{-1}$ (m_2); 7,5 g $polybag^{-1}$ (m_3); and 10,0 g $polybag^{-1}$ (m_4).Dosage factor of SP 36 (P) yang terdiri atas 4 taraf yaitu :tanpa pupuk

SP 36 which consists of 4 levels, namely: without SP fertilizer (p_0);1,0 g polybag $^{-1}$ (p_1); 1,5 g polybag $^{-1}$ (p_2); and 2,0 g polybag $^{-1}$ (p_3).

2.4 Research activities

The stages of research activities are: (1) preparation of planting media; (2) giving mycorrhizal treatment; (3) preparation of sprouts; (4) planting; (5) application of SP-36 fertilizer; (6) maintenance: watering, loosening the soil; and weed control; and (7) data collection and analysis.

2.5 Data retrieval

The data collected were: (1) analysis of the chemical properties of planting media before treatment, (2) height of seedlings aged 1, 2, and 3 months after planting; (3) stem diameter at 1, 2, and 3 months after planting; (4) number of leaves at 1, 2, and 3 months after planting; and (5 lengths of roots aged 4 months after planting.

2.6 Data analysis

Analysis of data from observations of seedling growth with variance and followed by a 5% BNT test if (F Count > F Table 5% and 1%).

III. RESULTS AND DISCUSSION

3.1 Chemical Properties of Planting Media Before Giving Treatment

The results of the analysis of growing media in the laboratory are presented in Table 1.

TABLE 1
RESULTS OF ANALYSIS OF CHEMICAL PROPERTIES OF PLANTING MEDIA BEFORE TREATMENT

Sample Code	pH	C Organic (%)	N Total (%)	C/N	P Bray (ppm)	K Morgan (ppm)	Al	H
1	7,78	1,25	0,16	7,70	1,71	42,31	0,00	0.00
2	8,11	1,01	0,14	7,24	1,46	69,23	0,00	0.00
3	8,05	1,33	0.11	11,89	1,95	51,54	0,00	0.00
4	8,15	2,09	0,15	13,79	1,46	52,31	0,00	0.00
5	8,08	1,16	0,13	9,02	3,17	43,85	0,00	0.00
Status	Alkalis	R - S	R	R - S	SR	T	SR	SR

Source: Soil Laboratory, Faculty of Agriculture, Unmul Samarinda (2019)
Description: SR = very low; R = low; S = moderate; and T = height.

Based on Table 1 shows that the pH of the growing media ranged from 7.78 - 8.15 (classified as alkaline), C-organic content was between 1.01 - 2.09% (classified as low to moderate), N-total content was between 0.11 - 0.16% (classified low), C/N ratio between 7.24 – 13.79 (classified low to moderate), P available between 1.46 – 3.17 ppm (classified very low), K available between 42 .31 – 69.23 ppm (classified high), the content of Al and H cations is 0 me/100 g of soil (classified very low).In general, the fertility status of the growing media is low.

3.2 Effect of Arbusquar Mycorrhizae and SP-36 Fertilizer and their Interaction

The results of the effect of Arbuskuar Mycorrhizae and SP-36 fertilizer and their interaction on the growth of oil palm seedlings in the pre-nursery phase are presented in Table 2 and 3.

TABLE 2
SEEDLING STEM HEIGHT AND DIAMETER GROWTH.

Factors Treatment	Height (cm) at ages			Diameter (cm) at ages		
	I BST	2 BST	3 BST	I BST	2 BST	3 BST
Mycorrhizal Treatment (M)	**tn**	**tn**	**tn**	**tn**	**tn**	**tn**
NoMycorrhizae (m_0)	5,20	14,53	19,58	1,23	1,73	2,03
2,5 g polibag^{-1} (m_1)	3,68	15,25	21,55	1,35	1,70	1,93
5,0 g polibag^{-1} (m_2)	5,08	13,23	19,15	1,25	1,65	1,95
7,5 g polibag^{-1} (m_3)	6,10	14,43	20,39	1,25	1,78	2,05
10,0 g polibag^{-1} (m_4)	4,58	13,80	19,67	1,25	1,70	2,03
SP-36 Treatment (P)	******	*****	******	******	**tn**	**tn**
Tanpa SP-36 (p_0)	7,20 a	15,92 a	22,54 a	1,42 a	1,78	2,10
1,0 g polibag^{-1} (p_1)	6,02 b	15,28 a	22,16 a	1,36 a	1,82	2,06
1,5 g polibag^{-1} (p_2)	4,24 c	12,70 b	18,26 b	1,14 b	1,62	1,92
2,0 g polibag^{-1} (p_3)	3,64 c	11,09 b	17,31 b	1,14 b	1,64	1,90
Interacation (Mx P)	**tn**	**tn**	**tn**	**tn**	**tn**	**tn**
m0p0	7,10	17,10	23,10	1,40	1,90	2,00
m0p1	5,90	15,50	23,50	1,40	1,90	2,30
m0p2	4,30	12,30	14,90	1,10	1,60	1,80
m0p3	3,50	13,23	16,83	1,00	1,50	2,00
m1p0	7,60	18,00	24,90	1,50	1,80	2,00
m1p1	5,80	13,40	21,00	1,40	1,60	1,80
m1p2	3,80	14,30	19,40	1,10	1,50	1,90
m1p3	4,50	15,30	20,90	1,40	1,90	2,00
m2p0	7,30	15,60	22,30	1,50	1,80	2,30
m2p1	6,60	16,50	22,30	1,40	1,80	2,10
m2p2	3,80	10,80	18,00	1,10	1,50	1,80
m2p3	2,60	10,00	14,00	1,00	1,50	1,60
m3p0	8,60	16,60	21,60	1,40	1,80	2,10
m3p1	7,00	15,90	23,50	1.50	1,90	2,00
m3p2	4,30	11,60	18,10	1,10	1,60	2,00
m3p3	4,50	13,60	18,30	1,00	1,80	2,10
m4p0	5,40	12,30	20,80	1,30	1,60	2,10
m4p1	4,80	15,10	20,50	1,10	1,80	2,10
m4p2	5,00	14,50	20,90	1,30	1,90	2,10
m4p3	3,10	13,30	16,50	1,30	1,50	1,80

Note: the average number followed by the letter which is not significantly different based on the results of the 5% BNT test. tn = not significant effect; * = significant effect; ** = very significant effect; and BST = month after planting

TABLE 3
GROWTH OF LEAF NUMBER AND ROOT LENGTH

Factors Treatment	Number of Leaves (Strands) at Age			Root Length at Age 4 BST (cm)
	1 BST	2 BST	3 BST	
Mycorrhizal Treatment (M)	**tn**	**tn**	**tn**	**tn**
NoMycorrhizae (m_0)	1,23	2,57	2,85	21,80
2,5 g polibag^{-1} (m_1)	1,35	2,48	2,90	24,00
5,0 g polibag^{-1} (m_2)	1,25	2,20	2,70	21,93
7,5 g polibag^{-1} (m_3)	1,38	2,45	3,00	21,58
10,0 g polibag^{-1} (m_4)	1,25	2,10	2,98	23,77
SP-36 Treatment (P)	******	**tn**	******	******
Tanpa SP-36 (p_0)	1,42 a	2,46	3,36 a	25,58 a
1,0 g polibag^{-1} (p_1)	1,36 a	2,49	3,06 a	26,40 a
1,5 g polibag^{-1} (p_2)	1,18 b	2,42	2,66 b	21,00 ab
2,0 g polibag^{-1} (p_3)	1,20b	2,36	2,47 b	17,40 b
Interaction(Mx P)	**tn**	**tn**	**tn**	**tn**
m0p0	1,40	3,00	3,50	28,30
m0p1	1,40	2,30	3,40	27,30
m0p2	1,10	2,50	2,40	26,30
m0p3	1,00	2,50	2,13	15,30
m1p0	1,50	2,30	3,50	25,30
m1p1	1,40	2,30	2,50	30,00
m1p2	1,10	2,80	2,80	21,70
m1p3	1,40	2,50	2,80	19,00
m2p0	1,50	2,50	3,30	29,30
m2p1	1,40	2,30	2,90	30,00
m2p2	1,10	2,00	2,30	10,70
m2p3	1,00	2,00	2,30	17,70
m3p0	1,40	2,50	3,00	27,30
m3p1	1,50	2,30	3,50	20,70
m3p2	1,30	2,50	2,50	21,00
m3p3	1,30	2,50	3,00	17,30
m4p0	1,30	2,00	3,50	27,70
m4p1	1,10	2,30	3,00	24,00
m4p2	1,30	2,30	3,30	25,70
m4p3	1,30	1,80	2,10	17,40

Note: the average number followed by the letter which is not significantly different based on the results of the 5% BNT test. tn = not significant effect; ** = very significant effect; and BST = month after planting

3.2.1 Effect of Arbuscular Mycorrhizae

The results of variance showed that arbuscular mycorrhizal inoculation had no significant effect on seedling height, stem diameter, number of leaves at 1, 2, and 3 months after planting, and root length at 4 months after planting.The results presented in Table 2 show that the mycorrhizal inoculation treatment (m1, m2, m3, and m4) resulted in seedling height at the age of 1 month after planting which ranged from 3.68 to 6.10 cm, while in the treatment without mycorrhizae (m0) which is 5.20 cm; seedling height at the age of 2 months after planting ranged from 13.23 to 15.25 cm, while in the treatment without mycorrhizae (m0) it was 14.53 cm; and seedling height at the age of 3 months after planting ranged from 19.15 to 21.55 cm, while in the treatment without mycorrhizae (m0) it was 19.58 cm.Mycorrhizal inoculation treatments (m1, m2, m3, and m4) produced seedling diameters at the age of 1 month after planting which ranged from 1.25 to 1.35 cm, while the treatment without mycorrhizae (m0) was 1.25 cm; seedling diameter at the age of 2 months after planting ranged from 1.65 to 1.78 cm, while in the treatment without mycorrhizae (m0) it was 1.73 cm; and the diameter of the seedlings at the age of 3 months after planting ranged from 1.93 to 2.05 cm, while in the treatment without mycorrhizae (m0) it was 2.03 cm.

The results presented in Table 3 show that the mycorrhizal inoculation treatment (m1, m2, m3, and m4) resulted in the number of seedling leaves at the age of 1 month after planting which ranged from 1.25 to 1.38 strands, while in the treatment without mycorrhizae (m0) ie 1.23 strands; the number of seedling leaves at the age of 2 months after planting ranged from 2.10 to 2.48 strands, while in the treatment without mycorrhizae (m0) it was 2.57 strands; and the number of seedling leaves at the age of 3 months after planting ranged from 2.70 to 3.00 leaves, while in the treatment without mycorrhizae (m0) it was 2.85 strands.Mycorrhizal inoculation treatments (m1, m2, m3, and m4) resulted in seedling root length at the age of 4 months after planting ranging from 21.58 to 24.00 cm, while the treatment without mycorrhizae (m0) was 21.80 cm.

In general, the results showed that the various doses of arbuscular mycorrhizal inoculation (m1, m2, m3, and m4) resulted in seedling height, stem diameter, number of leaves, and root length of oil palm seedlings in the pre-nursery phase which were not significantly different compared to the treatment without arbuscular mycorrhizal inoculation (m0).This situation can be caused by internal factors of the seeds themselves, namely oil palm seedlings in the pre-nursery phase, which are still in early growth, so they have few roots.This condition causes the infection of mycorrhizal inoculum with the roots of oil palm seedlings has not/did not work as expected.Mycorrhizal inoculation process requires time and a process that is not short. Mycorrhizal inoculation requires good media so that it is able to maintain mycorrhizal conditions according to their natural characteristics.

In addition to these factors, the condition factor of the chemical properties of the growing media which is classified as infertile, with the following characteristics, namely having a pH (7.78-8.15) is classified as alkaline, the content of organic matter (1.01-2.09%) is classified as alkaline. low to moderate, the total N content (0.11 – 0.16%) is low, the P content (1.46 – 1.95 ppm) is very low and the K content (42.31 – 69.23 ppm) is classified as low. high, and very low Al and H content (Table 1).With these chemical conditions, oil palm seedlings cannot grow optimally, seedling roots are underdeveloped, so that it affects mycorrhizal infections to oil palm seedling roots.As stated by [8] that in each plant the percentage of infection is different, this may be due to differences in several factors that affect mycorrhizal infection in plants, including: dependence of plants on mycorrhizae, effectiveness of isolates, and condition of elements. nutrients / nutrients. Furthermore, it was stated [9] that the development of arbuscular mycorrhizae was influenced by the sensitivity of the host plant to infection, light intensity, temperature, soil moisture content, soil pH, organic matter, root residues, availability of nutrients, heavy metals and fungicides.

3.2.2 Effect of SP-36 Pupuk Fertilizer

The results of variance showed that the SP-36 fertilizer treatment had a significant to very significant effect on seedling height at 1, 2, and 3 months after planting.The results presented in Table 2 show that the treatment with various doses of SP-36 fertilizer (p1, p2, and p3) resulted in seedling height at the age of 1 month after planting which ranged from 3.64 to 6.02 cm without SP-36 fertilizer (p0) which is 7.20 cm; seedling height at the age of 2 months after planting ranged from 11.09 to 15.28 cm, while the treatment without SP-36 fertilizer (p0) was 15.92 cm; and seedling height at the age of 3 months after planting ranged from 17.31 to 22.16 cm, while the treatment without SP-3a (p0) was 22.54 cm.

The results of variance showed that the SP-36 fertilizer treatment had a very significant effect on seedling diameter at 1 month after planting, but had no significant effect on seedling diameter at 2 and 3 months after planting.The results presented in Table 2 show that the treatment with SP-36 fertilizer (p1, p2, and p3) resulted in seedling diameter at the age of 1 month after planting which ranged from 1.14 to 1.36 cm, while in the treatment without fertilizer SP-36 (p0) is 1.42 cm; seedling diameter at the age of 2 months after planting ranged from 1.62 to 1.82 cm, while in the treatment without SP-36 fertilizer (p0) it was 1.78 cm; and the diameter of the seedlings at the age of 3 months after planting ranged from 1.90 to 2.05 cm, while the treatment without SP-3a (p0) fertilizer was 2.10 cm.

The results of variance showed that the SP-36 fertilizer treatment had a very significant effect on the number of seedling leaves at the age of 1 and 3 months after planting, but had no significant effect on the number of seed leaves at the age of 2 months after planting.The results presented in Table 3 show that the treatment with SP-36 fertilizer (p1, p2, and p3) resulted in the number of leaves of seedlings at the age of 1 month after planting which ranged from 1.20 to 1.36 strands, while in the treatment without fertilizer SP-36 (p0) which is 1.42 strands; the number of seedling leaves at the age of 2 months after planting ranged from 2.36 to 2.49 strands, while in the treatment without SP-36 fertilizer (p0) it was 2.46 strands; and the number of seedling leaves at the age of 3 months after planting ranged from 2.47 to 3.06 strands, while in the treatment without SP-3a fertilizer (p0) it was 3.36 strands.

The results of variance showed that the SP-36 fertilizer treatment had a very significant effect on the root length of the seedlings at 4 months after planting.The results presented in Table 12 (recapitulation) show that the treatment with SP-36 fertilizer (p1, p2, and p3) resulted in seedling root length at the age of 4 months after planting which ranged from 17.40 to 26.40 cm, while the treatment without SP-36 fertilizer (p0) was 25.58 cm.

In general, the results showed that the application of SP-36 fertilizer, especially at a dose of 1.5 g polybag-1 (p2) and 2.0 g polybag-1 (p3) tended to reduce growth in height, stem diameter, number of leaves at the age of 1, 2, and 3 months after planting and root length of oil palm seedlings at 4 months after planting.This situation is due to the fact that oil palm seedlings in the pre-nursery phase are still in the early stages of growth, so they do not need nutrients like mature plants, with nutrient content in the planting medium (based on the results of laboratory analysis of organic matter content of 1.01 - 2 ,09% (low – moderate), N-total content of 0.11 – 0.16% (low), P content of 1.46 – 1.95 ppm (very low) and K content of 42, 31 – 69.23 ppm (high enough) has met the nutrient/nutrient needs of the seeds, and the addition of SP-36 fertilizer tends to inhibit the growth of oil palm seedlings.As stated by [10] that plant growth is influenced by the availability of nutrients in the soil.Growth is an increase in the number and dimensions of plants, both diameter and height in a plant.Plant growth will increase if plant nutrients are met or vice versa. Added by [11] that the needs of plants for various fertilizers/nutrients during growth and development are not the same, require different times/times and are not the same in number.Furthermore, it is stated by [12] that plants will thrive and give good results if the nutrients they need are available in sufficient and balanced quantities.

3.2.3 Effect of Interaction between Arbuscular Mycorrhizal Inoculation and SP-36 Fertilizer

The results of variance showed that the interaction between arbuscular mycorrhizal inculation factors and SP-36 fertilizer had no significant effect on seedling height at 1, 2 and 3 months after planting, seedling stem diameter at 1, 2 and 3 months after planting, number of seedling leaves. at 1, 2 and 3 months after planting and root length of seedlings at 4 months after planting.This situation indicates that the arbuscular mycorrhizal inoculation factor and the SP-36 fertilizer factor did not simultaneously affect the growth of oil palm seedlings in the pre-nursery phase.As stated by [13] that if the effect of the different interactions is not significant, it can be concluded that the treatment factors act independently of each other.

In general, the results presented in Tables 2 and 3 show that the combination treatment between various doses of arbuscular mycorrhizal inoculation and various doses of SP-36 fertilizer tended to result in lower seedling height growth, smaller stem diameter, fewer number of leaves, and lower growth rates.The root length of oil palm seedlings in the pre-nursery phase was shorter than the combination without arbuscular mycorrhizae and without SP-36 fertilizer and with arbuscular mycorrhizae and without SP-36 fertilizer.There was no interaction or independent effect of giving mycorrhizae on the growth of oil palm seedlings.It was assumed that the available P content in the soil was sufficient so that the application of mycorrhizae and SP-36 fertilizer did not have a significant effect on the vegetative growth of seedlings.According to [14] that the condition of the nutrients in the soil is sufficient and adequate if given fertilizer containing nutrients it will show a slight increase in yield or less response to fertilization.Besides that, it is suspected that phosphate is not needed much in the early growth process of oil palm seedlings.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

Conclusion Based on the results of research and discussion, conclusions can be drawn, as follows:

1. Provision of arbuscular mycorrhizae had no significant effect on growth height, stem diameter, number of leaves of seedlings at 1, 2, and 3 months after planting, and root length of seedlings at 1 month after planting.
2. Application of SP-36 fertilizer had a significant to very significant effect on height growth at 1, 2, and 3 months after planting, seedling diameter at 1 month after planting, number of leaves at 1 and 3 months after planting, and root length of seedlings. at 4 months after planting. The application of SP-36 fertilizer at a dose of 1.5 – 2.0 g plant-1 tends to inhibit the growth of oil palm seedlings in the pre-nursery phase.
3. There is no interaction between mycorrhizal treatment and SP-36 fertilizer treatment on the growth of oil palm seedlings in the pre-nursery phase.

4.2 Suggestion

Based on the results of the study, several suggestions can be put forward, namely as follows:

1. In the pre-nursery phase of oil palm nurseries, mycorrhizal inoculation and application of SP-36 fertilizer are not necessary.
2. Further research is needed regarding the application of mycorrhizae and SP-36 fertilizer as well as nitrogen fertilizer in oil palm seedlings in the main nursery phase.
3. In further research, a longer research time is considered until the seedlings are ready to be transferred to the field.

REFERENCES

[1] https://sawitindonesia.com/main-nursery-kelapa-sawit/diakses diakses 20 January 2021.

[2] https://spks.or.id/file/publikasi/4__SOP_PEMBIBITAN_Fixed-edit1.pdf/diakses 20 January 2021

[3] Darmosarkoro, W.Akiyat, Sugiyono, and Edy Sigit Sutarta, 2008. Oil Palm Nurseries, How to Get Jagur Seeds. Palm Oil Research Center, Medan.

[4] Sutanto, R. 2002. Organic Farming: Towards Alternative and Sustainable Agriculture. Kanisius, Yogyakarta.

[5] Suprapto and I. B. Ariba. 2002. Effect of Residues of Several Types of Organic Fertilizers on Growth and Yield of Shallots in Dry Land. Online (http:www.bptp.jatim deptan.go.id/templates/16 suprapto, p).

[6] Dela Cruz, R.E., H.T. Bartolome and N.S. Anggangan.1988. Pilot Testing of Mycorrhizal Tablets for Pines and Eucalyptus in the Philippines. Publ. by UPLB. The Philippine.

[7] Humphreys, C. P., Franks, P. J., Rees, M., Bidartondo, M. I., Leake, J. R., & Beerling, D. J. (2010). Mutualistic Mycorrhiza-like Symbiosis in the Most Ancient Group of Land Plants. Nature Communications, 1, 103

[8] Setiadi Y. 1995. The Practical Application of Arbuscular Mycorrizhae Fungi for Reforestation in Indonesia [Thesis]. Kent: Research School of Biosciences, University of Kent.

[9] Indriani, N.P., Mansyur, Susilawati, I. and Islami, R.Z.2011. Improving the Productivity of Feed Plants Through Arbuscular Mycorrhizal Fungi (FMA).Pastura 1(1) : 27 -30

[10] Wulandari, A.S. and Susanti, S. 2012. Application of Organic Leaf Fertilizer to Increase Jabon Seed Growth (*Anthocephalus cadamba* Roxb. Miq.). Journal of Tropical Silviculture. 3(2): 137 -142.

[11] Mulyani Sutejo, M. and A.G. Kartasapoetara. 2002. Fertilizer and Fertilization Method. Bina Aksara, Jakarta.

[12] Dwidjoseputro, D. 1998 . Introduction to Plant Physiology. Gramedia, Jakarta

[13] Steel, R.G.D and J. H. Torrie. 1991. Statistical Principles and Procedures of a Biometric Approach. Gramedia Pustaka Utama, Jakarta.

[14] Rosmarkam, A. and N. W, Yuwono 2002. Soil Fertility Science.Kanisius, Yogyakarta