Open Science and Technology
Vol. 03 No. 02, 2023 (74-82)
ISSN (Print) :2776-169X
ISSN (Online) :2776-1681

Effect of Application Frequency of Oil Palm Fronds (*Elaeis guineensis* Jacq.) Local Microorganisms on the Growth of *Eucalyptus grandis* CGP 105 Seedlings

Pengaruh Frekuensi Pemberian MOL Pelepah Kelapa Sawit (Elaeis guineensis Jacq.) terhadap Pertumbuhan Bibit Eucalyptus grandis CGP 105

Yudia Azmi[1*], Melfa Sulvia Lumban Batu[1], Nursyam Arrozi[1]
[1]Agrotechnology Study Program, Pelalawan Institute of Plantation Technology, Indonesia
*email: udiaazmi@gmail.com

Submitted:12 January 2024 Accepted: 20 January 2024 Published: 21 January 2024

ABSTRAK

Penelitian ini bertujuan mengetahui pengaruh frekuensi pemberian mikroorganisme local (MOL) pelepah kelapa sawit (*Elaeis guineensis* Jacq.) terhadap pertumbuhan bibit *Eucalyptus grandis* CGP 105, serta mengetahui frekuensi pemberian MOL yang menghasilkan pertumbuhan terbaik pada tanaman *Eucalyptus grandis* CGP 105. Penelitian ini menggunakan Rancangan Acak Kelompok (RAK) yang terdiri dari 5 perlakuan dan 4 ulangan, yaitu P0: tanpa MOL (kontrol), P1: 1 kali pemberian (7 hari setelah tanam/HST), P2: 2 kali pemberian (7 dan 14 HST), P3: 3 kali pemberian (7, 14, dan 21 HST), dan P4: 4 kali pemberian (7, 14, 21, dan 28 HST). Parameter yang diamati meliputi tinggi tanaman (cm), panjang daun (cm), lebar daun (cm), jumlah daun (helai), dan diameter batang (mm). Hasil uji ANOVA pada taraf 5% menunjukkan bahwa pemberian MOL pelepah kelapa sawit pada bibit *Eucalyptus grandis* CGP 105 berpengaruh terhadap semua parameter yang diamati. Frekuensi pemberian MOL pelepah kelapa sawit terbaik adalah perlakuan P4, yang menghasilkan rerata tinggi tanaman 25,83 cm, panjang daun 7,47 cm, lebar daun 3,54 cm, jumlah daun 13,25 helai, dan diameter batang 2,45 mm.

Kata kunci: *Eucalyptus grandis* CGP 105, Mikroorganisme Lokal, Pelepah Kelapa Sawit.

ABSTRACT

This study aims to determine the effect of application frequency of oil palm fronds' local microorganisms (LMO) on the growth of Eucalyptus grandis *CGP 105 seedlings, and to determine the application frequency that produce the best growth on* Eucalyptus grandis *CGP 105 plants. This study applied Randomized Block Design consisting of 5 treatments and 4 replications, namely P0: without LMO (control), P1: 1 time of application (7 days after planting/DAP), P2: 2 times of application (7 and 14 DAP), P3: 3 times of application (7, 14, and 21 DAP), and P4: 4 times of application (7, 14 , 21, and 28 DAP). The parameters observed were plant height (cm), leaf length (cm), leaf width (cm), number of leaves (strands), and stem diameter (mm). Based on ANOVA results at the 5% level, the application of oil palm fronds' LMO on* Eucalyptus grandis *CGP 105 seedlings had a significant effect on all measured parameters. The best application frequency of oil palm fronds' LMO is P4 treatment, which resulted in the average of plant height of 25.83 cm, leaf length of 7.47 cm, leaf width of 3.54 cm, number of leaves of 13.25 strands, and stem diameter of 2.45 mm.*

***Keywords*:** *Eucalyptus grandis* CGP 105, Local Microorganisms, Oil Palm Fronds.

Open Science and Technology
Vol. 03 No. 02, 2023 (74-82)
ISSN (Print) :2776-169X
ISSN (Online) :2776-1681

INTRODUCTION

Eucalyptus grandis is a species of genus *Eucalyptus* that is widely used in Indonesian industry. Riau Province is a timber producing region that is quite extensive and productive. Based on data by Central Bureau of Statistics (2018), logs production from *Eucalyptus* plants reached 7,953,573 m^3. The area of Industrial Plantation Forest (HTI) in Riau Province is 5,352,502.00 ha (Central Bureau of Statistics, 2021). *Eucalyptus grandis* CGP 105 exhibits several advantages compared to those of other *Eucalyptus* species, namely this species can grow to a height of up to tens of meters, more resistant to disease attacks, and can grow faster with high yields. An important stage in the cultivation of *Eucalyptus grandis* CGP 105 is nursery. Nursery is one of the initial stages that greatly determines the growth of *Eucalyptus grandis* CGP 105 seedlings before they become productive plants in the field. According to Jannah et al. (2022), nursery is the first step of the whole series of *Eucalyptus grandis* cultivation activities that greatly affect both plant productivity and plant productive age.

Providing nutrients at seedling stage is one of the important steps to optimize plant growth and development, which in turn can increase yield production. Local microorganisms (LMO) are organic liquids whose raw materials can be obtained from natural resources that are locally available from the surrounding environment (Suhastyo & Setiawan, 2017). LMO contain micro and macronutrients and also contains bacteria that benefit plant growth so that LMO has the potential as an organic matter breaker, liquid organic fertilizer, and pest control agent. Oil palm fronds (*Elaeis guineensis* Jacq.) are one of the agricultural wastes that have the potential to be used as raw materials in making LMO. Oil palm fronds have been underutilized by farmers and are more often regarded as waste because they are usually piled up in dead weeds (Febiola & Ukrita, 2022). A study by Novrianti (2021) reported that oil palm fronds can be used as raw material for making LMO. Making LMO from oil palm fronds requires a fermentation time of two weeks, in which rice soaking water is the best solvent in this process. Oil palm fronds' LMO has several characteristics, namely pH of 3.40; Ec of 7.51 µS/cm; total dissolve solids (TDS) of 3.78 ml/l; organic C of 7.53%; total N of 0.03%; P_2O_5 of 0.17%; K_2O of 3.33%; and bacterial population of 3.42 x 10^3 cfu/ml.

Based on the above background, it is necessary to conduct a study in order to investigate the effect of the application frequency of oil palm fronds' LMO on the growth of *Eucalyptus grandis* CGP 105 seedlings. This mainly aims to determine its effect on seedling growth and determine which treatment of oil palm fronds' LMO application that produces the best results on the growth of *Eucalyptus grandis* CGP 105 seedlings.

MATERIALS AND METHODS

This study was conducted from May to July 2023 at Campus Pembantu Research Field, Pelalawan Institute of Plantation Technology, Pangkalan Kerinci, Pelalawan Regency, Riau Province. The tools used in this study were paranet, polybag measuring 22 x 14 cm, sieve, bucket, tray, measuring cup, ruler, screw micrometer, machete, camera, and stationery. The materials used in this study were *Eucalyptus grandis* CGP 105 seedlings, cocopeat, top soil layer, water, label paper, oil palm fronds, brown sugar, and rice soaking water. The method adopted in this research was Randomized Group

Design (RGD). The treatment was conducted in the form of the application frequency of oil palm fronds' local microorganisms (LMO). There were five treatments with four replications at each treatment. Each treatment is detailed as follows.

P0 = without local microorganism (control)
P1 = 1 time of application (7 days after planting/DAP)
P2 = 2 times of application (7 dan 14 DAP)
P3 = 3 times of application (7, 14, dan 21 DAP)
P4 = 4 times of application (7, 14, 21, dan 28 DAP)

The data obtained were analyzed using analysis of variance (ANOVA) in Statistical Program for Social Science (SPSS) software. If there was a difference among treatments, the data analysis was then proceeded to the Duncan Multiple Range Test (DMRT) at the 5% level to find out where the significant difference among treatments lies. According to Rochiman (2008), the general model of group randomized design applies the following formula:

$$Yij = \mu + \tau i + \beta j + \varepsilon ij$$

Description:
Yij = observation value in i-th treatment and j-th replication
μ = general median
τi = effect of i-th treatment
βj = effect of j-th replication
ε ij = experimental error in i-th treatment and j-th replication

The research implementation included the following steps: preparing the land, making the shade, retrieving the oil palm fronds, making the fermentation bottles, retrieving the *Eucalyptus grandis* CGP 105 seedlings, making the oil palm fronds' LMO, preparing the planting media, applying the oil palm fronds' LMO treatment, and maintain the plants. The parameters observed were plant height, leaf length, leaf width, number of leaves, and stem diameter.

RESULTS AND DISCUSSION

Plant Height

The DMRT results regarding the effect of application frequency of oil palm fronds' LMO on the height of *Eucalyptus grandis* CGP 105 plants in Table 1.

Table 1. Plant height of *Eucalyptus grandis* CGP 105.

Treatment	Plant Height (cm) at 35 DAP
P0	14.17 a
P1	17.44 b
P2	19.39 c
P3	23.07 d
P4	25.83 e

Description: P0 (control), P1 (1 time of application), P2 (2 times of application), P3 (3 times of application), P4 (4 times of application). Numbers followed by the same letter in the same column indicate no significant difference based on the results of DMRT at the 5% level.

As seen in Table 1, the application of oil palm fronds' LMO produced significant differences among all treatments. This can be seen through the notations a, b, c, d, and e on the height of *Eucalyptus grandis* CGP 105 plants. The result of P4 treatment, with the notation e, is significantly different from that of P0 (control), P1, P2, and P3. P4 treatment produced the best average plant height, namely 25.83 cm. This is in line with a study by Tamnge (2022), that liquid organic fertilizer produced the best plant height in balsa plants, namely 57.60 cm, through 4 times of application.

Kerinci Central Nursery 2 (2021) stated that the height of *Eucalyptus grandis* CGP 105 plants ranges from 15–20 cm at the age of 2 months. Meanwhile, P4 treatment produced an average plant height of 25.83 cm. This means the application of oil palm fronds' LMO with a frequency of 7, 14, 21, and 28 DAP was able to accelerate the growth of *Eucalyptus grandis* CGP 105 plant height. This result is also in line with Hermina et al. (2014), that pineapples' LMO produced the best plant height in Bantul black rice plants, namely 60.06 cm, through the application frequency of 7, 14, 21, and 28 DAP. Thereby, the 4 times application of oil palm fronds' LMO had a positive effect on the height of the *Eucalyptus grandis* CGP 105 plant. A study by Putra (2022) reported that oil palm fronds' LMO was very influential on the height of lettuce plants, which resulted in an average plant height of 6.72 cm.

The growth of plant height are highly influenced by the availability and balanced condition of nutrients in the soil, such as N, P, and K. A study by Novrianti (2021) showed that oil palm fronds' LMO that uses rice water solvent typically contains organic C value of 7.53%, total N of 0.03%, P_2O_5 of 0.17% and K_2O of 3.33%. These nutrients are necessary in the process of cell division for increasing the height of plants.

Leaf Length

The DMRT results regarding the effect of application frequency of oil palm fronds' LMO on the leaf length of *Eucalyptus grandis* CGP 105 plants are presented in Table 2.

Table 2. Leaf length of *Eucalyptus grandis* CGP 105.

Treatment	Leaf Length (cm) at 35 DAP
P0	4.13 a
P1	5.14 b
P2	5.85 c
P3	6.63 d
P4	7.74 e

Description: P0 (control), P1 (1 time of application), P2 (2 times of application), P3 (3 times of application), P4 (4 times of application). Numbers followed by the same letter in the same column indicate no significant difference based on the results of DMRT at the 5% level.

As seen in Table 2, the application of oil palm fronds' LMO produced significant differences among all treatments. This can be seen through the notations a, b, c, d, and e on the leaf length of *Eucalyptus grandis* CGP 105. The result of P4 treatment, with the notation e, is significantly different from that of P0 (control), P1, P2, and P3. P4 treatment produced the highest average leaf length of *Eucalyptus grandis* CGP 105, namely 7.74 cm. This is thought to be due to the optimal concentration and application

frequency that can accelerate the growth of leaf length of *Eucalyptus grandis* CGP 105 plants.

Kerinci Central Nursery 2 (2021) stated that the leaf length of *Eucalyptus grandis* CGP 105 plants ranges from 5–7 cm at the age of 2 months. Meanwhile, P4 treatment produced an average leaf length of 7.74 cm. This means the application of oil palm fronds' LMO with a frequency of 7, 14, 21, and 28 DAP was able to accelerate the growth of leaf length of *Eucalyptus grandis* CGP 105 plants. Thereby, 4 times of application of oil palm fronds' LMO had a positive effect on the leaf length of *Eucalyptus grandis* CGP 105. This result is in line with Putra (2022), that oil palm fronds' LMO affected the growth of lettuce plants by producing the longest leaf, namely 7.90 cm, through 4 times of application, namely 7, 14, 21, and 28 DAP. This proves that the microbial content in oil palm fronds' LMO can break down the available nutrients into nitrogen, which is useful in leaf formation process.

According to Fauziyah et al. (2020), the treatment of compost doses of 20 to 30 tons/ha and 2 times of application of banana pith' LMO was able to improve soil organic matter. Jannah et al. (2022) found that N element plays a role in the formation of chlorophyll cells, as chlorophyll is undeniably essential for photosynthesis, thus N element helps to create the energy needed for cells to divide and enlarge. Furthermore, Nursanti (2010) stated that the addition of N element can stimulate vegetative growth, namely branches, stems, and leaves. Besides, N element is also a major constituent of amino acids, proteins, and cell protoplasm. N element plays a very important role in increasing the leaf length of *Eucalyptus grandis* CGP 105 plants, which means it also participates in increasing the rate of photosynthesis and carbohydrate production.

Leaf Width

The DMRT results regarding the effect of the application of oil palm fronds' LMO on the leaf width of *Eucalyptus grandis* CGP 105 plants are presented in Table 3.

Table 3. Leaf width of *Eucalyptus grandis* CGP 105.

Treatment	Leaf Width (cm) at 35 DAP
P0	1,55 a
P1	2.44 b
P2	2.69 b
P3	2.69 b
P4	3.15 c

Description: P0 (control), P1 (1 time of application), P2 (2 times of application), P3 (3 times of application), P4 (4 times of application). Numbers followed by the same letter in the same column indicate no significant difference based on the results of DMRT at the 5% level.

As seen in Table 3, the application of oil palm fronds' LMO produced significant differences among the majority of treatments. This can be seen through the notations a, b, b, b, and c on the leaf width of *Eucalyptus grandis* CGP 105. The result of P4 treatment, with the notation c, is significantly different from that of P0 (control), P1, P2, and P3. P4 treatment produced the highest average leaf width, namely 3.15 cm. Kerinci Central Nursery 2 (2021) stated that the leaf width of *Eucalyptus grandis* CGP 105 plants ranges from 2–3 cm at the age of 2 months. Meanwhile, P4 treatment produced

an average leaf width of 3.15 cm. This means the application of oil palm fronds' LMO with a frequency of 7, 14, 21, and 28 DAP was able to significantly accelerate the growth of leaf width of *Eucalyptus grandis* CGP 105 plants. Thereby, 4 times of application of oil palm fronds' LMO had a positive effect on the leaf width of *Eucalyptus grandis* CGP 105 plants. This result is in line with Putra (2022), that oil palm fronds' LMO affected the growth of lettuce plants by producing the highest average leaf width, namely 5.07 cm, through 4 times of application, namely 7, 14, 21, and 28 DAP.

The growth of leaf width in *Eucalyptus grandis* CGP 105 plants is influenced by the nutrients contained in oil palm fronds' LMO. Nutrients that play an important role in the growth of leaf width are nitrogen (N), phosphorus (P), calcium (C), and carbohydrates. N is the main element needed by plants for the growth and formation of their vegetative organs, namely stems, leaves, and roots (Oktaningtiyas, 2015). N element contained in oil palm fronds' LMO is thought to be highly responsible for triggering an increase in leaf width of *Eucalyptus grandis* CGP 105 plants.

Number of Leaves

The DMRT results regarding the effect of application frequency of oil palm fronds' LMO on the number of leaves of *Eucalyptus grandis* CGP 105 plants are presented in Table 4.

Table 4. Number of leaves of *Eucalyptus grandis* CGP 105.

Treatment	Number of Leaves (strands) at 35 DAP
P0	4.50 a
P1	6.75 b
P2	9.50 c
P3	11.50 d
P4	13.25 e

Description: P0 (control), P1 (1 time of application), P2 (2 times of application), P3 (3 times of application), P4 (4 times of application). Numbers followed by the same letter in the same column indicate no significant difference based on the results of DMRT at the 5% level.

As seen in Table 4, the application of oil palm fronds' LMO produced significant differences among all treatments. This can be seen in the notations a, b, c, d, and e on the number of leaves of *Eucalyptus grandis* CGP 105 plants. The result of P4 treatment, with the notation e, is significantly different from that of P0 (control), P1, P2, and P3. P4 treatment produced the highest average number of leaves, namely 13.25 strands. This result is considered significantly higher than that of a study by Tamnge (2022), which only produced 5.87 strands of balsa plants through 4 times of application of liquid organic fertilizer.

Kerinci Central Nursery 2 (2021) stated that the number of leaves of *Eucalyptus grandis* CGP 105 are around 4 strands at the age of 2 months. This means the result of P4 treatment indicates that the application of oil palm fronds' LMO with a frequency of 7, 14, 21, and 28 DAP was able to significantly accelerate the growth of the number of leaves of *Eucalyptus grandis* CGP 105. Thereby, 4 times of application of oil palm fronds' LMO had a positive effect on the number of leaves of *Eucalyptus grandis* CGP

105. This result is also in line with Putra (2022), that oil palm fronds' LMO affected the growth of lettuce plants by producing the highest average number of leaves, namely 9.00 strands, through 4 times of application, namely 7, 14, 21 and 28 DAP.

The application of oil palm fronds' LMO triggered the growth of more leaves, and was able to improve the physical and chemical properties of the soil, which greatly determine the growth of *Eucalyptus grandis* CGP 105 plants. Leaf formation is influenced by the elements such as N, Fe, and Mg. Oil palm fronds' LMO contain N element, which plays a role to increase the number of leaves. According to Panggabean et al. (2023), the N element contained in organic fertilizer is highly influential in increasing the number of leaves. The taller the seedlings, the more the place available to grow leaves (nodes), which causes the number of leaves on the seedlings to increase. The dose and frequency of application highly determine the growth of the seedlings.

Stem Diameter

The DMRT results regarding the effect of application frequency of oil palm fronds' LMO on the stem diameter of *Eucalyptus grandis* CGP 105 plants are presented in Table 5.

Table 5. Stem diameter of *Eucalyptus grandis* CGP 105.

Treatment	Stem Diameter (mm) at 35 DAP
P0	1.23 a
P1	1.45 ab
P2	1.76 bc
P3	1.99 c
P4	2.45 d

Description: P0 (control), P1 (1 time of application), P2 (2 times of application), P3 (3 times of application), P4 (4 times of application). Numbers followed by the same letter in the same column indicate no significant difference based on the results of DMRT at the 5% level.

As seen in Table 5, the application of oil palm fronds' LMO produced significant differences among the majority of treatments. This can be seen in the notations a, ab, bc, c, and d on the stem diameter of *Eucalyptus grandis* CGP 105. The result of P4 treatment, with the notation of d, is significantly different from that of P0 (control), P1, P2, and P3. P4 treatment produced the highest average stem diameter, namely 2.45 mm. Kerinci Central Nursery 2 (2021) stated that the stem diameter of *Eucalyptus grandis* CGP 105 is around 1.8 mm at the age of 2 months. Therefore, the result of P4 treatment indicates that the application of oil palm fronds' LMO with a frequency of 7, 14, 21, and 28 DAP was able to accelerate the growth of stem diameter of *Eucalyptus grandis* CGP 105. This means 4 times of application frequency of oil palm fronds' LMO had a positive effect on the stem diameter of *Eucalyptus grandis* CGP 105. Nutrient that plays a highly important role in the growth of stem diameter is phosphorus (P). Phosphorus is the main element needed by plants to support and sustaining stem growth. Jumin (2012) stated that the macroelements, such as N, P, K, are required by plants to stimulate the growth of stem diameter and roots, especially the roots of young plants.

CONCLUSIONS

Based on the results of this study, it can be concluded that the application frequency of oil palm fronds' LMO has positively influenced the growth of *Eucalyptus grandis* CGP 105 seedlings, namely by affecting plant height, leaf length, leaf width, number of leaves, and stem diameter. The application of oil palm fronds'LMO that produced the best growth of *Eucalyptus grandis* CGP 105 seedlings in all parameter observed was P4 treatment (4 times of application).

REFERENCES

Central Bureau of Statistics (2018). *Production value of logs 2016–2018*. Retrieved May 1, 2023, from https://www. bps.go.id.

Central Bureau of Statistics (2021). *Export value of wood products 2018–2021*. Retrieved February 24, 2023, from https://www.bps.go.id.

Fauziyah, N. H., Budiyanto, S., & Sudarman, A. D. (2020). Pengaruh pupuk kompos dan frekuensi pemberian MOL bonggol pisang terhadap pertumbuhan dan produktivitas stroberi (*Fragaria* sp.). *Buana Sains*, *20*(1), 29–40.

Febiola, A., & Ukrita, I. (2022). Manajemen panen kelapa sawit di Afdeling I PTPN VI Pangkalan Lima Puluh Kota. *Journal of Agribisnis*, *11*(2), 2–3.

Hermina, I., Purwanto, E., & Raharjo, S. P. (2014). Pengaruh frekuensi pemberian MOL nenas terhadap hasil dan kualitas hasil beberapa varietas padi hitam. *Agrosains: Jurnal Penelitian Agronomi*, *3*(2), 33–37.

Jannah, S. R., Hatta, G. M., & Basir, B. (2022). Kesehatan tanaman kayu putih (*Melalaeuca leucadendra* Linn.) di lahan rehabilitasi daerah aliran sungai (DAS) Gunung Batu, Desa Tebing Siring Pelaihari, Kabupaten Tanah Laut. *Jurnal Sylva Scienteae*, *5*(2), 292–300.

Jumin, H. B. (2012). *Suatu pendekatan fisiologis*. PT. Raja Grafindo Persada.

Kerinci Central Nursery 2 (KCN) 2. (2021). *Module competency operasional nursery*. PT. RAPP.

Novrianti, D. (2021). Pembuatan dan analisis kualitas larutan mikroorganisme (MOL) pelepah kelapa sawit. [Undergraduate Thesis]. Sekolah Tinggi Teknologi Pelalawan, 53 pp.

Nursanti, I. (2010). Tanggapan pertumbuhan bibit kelapa sawit (*Elaeis guineensis* Jacq.) terhadap aplikasi pupuk organik berbeda dosis. *Jurnal Ilmiah Universitas Batanghari Jambi*, *2*(2), 13–17.

Oktaningtiyas, L. (2015). Efektifitas mikroorganisme lokal (MOL) kulit pisang dan bonggol pisang terhadap pertumbuhan tanaman selada (*Lactuca sativa* L.) pada media hidroponik. [Publication Script]. Faculty of Teachership and Education Science. Surakarta Muhammadiyah University.

Panggabean, R., Azwin., & Suhesti, E. (2023). Respons bibit *Eucalyptus pellita* terhadap pemberian pupuk organik cair TOP G2. *Green Tech: Jurnal Ilmu Lingkungan*, *1*(1), 50–59.

Putra, I. H (2022). Aplikasi mikroorganisme lokal (MOL) pelepah kelapa sawit terhadap pertumbuhan dan produksi tanaman selada (*Lactuca sativa* L.). [Undergraduate Thesis]. Pelalawan Institute of Plantation Technology, 67 pp.

Rochiman, K. S. (2008). *Perancangan percobaan*. Surabaya: University Press.

Suhastyo, A. A., & Setiawan, B. H. (2017). Aplikasi pupuk cair MOL pada tanaman padi metode SRI (*System of Rice Intensification*). *Agritech Jurnal*, *19*(1), 26–34.

Tamnge, Z. X. (2022). Pengaruh macam pupuk organik cair dan frekuensi pemberian terhadap pertumbuhan bibit balsa (*Ochroma biocolor* Rowlee). [Undergraduate Thesis]. Malang Muhammadiyah University, 49 pp.