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Growth Response of Oil Palm Seedlings (Elaeis guineensis Jacq) in Pre Nursery Nurseries to Intersity of Solar Radiation in the Moonsun Region

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mustard oil; radiation intensity; pre-nursery nurseries

Abstract
Oil palm is a vegetable oil-producing plant and one of the nine basic needs of the Indonesian people. The high demand for cooking oil in the country must be balanced by maximizing production sources in the agronomic stage, namely through nurseries. Oil palm seeds at the pre-nursery level only require about 40% sunlight intensity. Therefore, radiation intensity is a factor that must be considered in the growth of seedlings at the pre-nursery level. The aim of the study was to analyze the response of oil palm seedling growth to the effect of radiation intensity in the pre nursery and to analyze the best radiation intensity on the growth of oil palm seedlings in the pre nursery. This study used a single factor Completely Randomized Environmental Design (CRD), i.e. radiation intensity consisting of 5 levels, namely p0 = (0%, 50%, 100%), p1 = (25%, 25%, 100%), p2 = (25%, 50%, 75%) radiation intensity, p3 = (25%, 75%, 100%), p4 = (50%, 75%, 100%). Repeat each treatment 4 times so that there are 20 experimental units. Each experimental unit contained 9 polybags so that there were a total of 180 plants. Based on the results of growth analysis of stem diameter (mm), number of leaves (leaves), length of leaf blade (cm) response to solar radiation intensity p3 = (25%, 75%, 100%).

1. Introduction

Oil palm is an oil-producing plant. Palm oil is the most important raw material for producing cooking oil. Strong domestic demand for vegetable oil shows that this commodity plays an important role in the national economy (Yusoff et al. 2021). Oil palm nurseries are one of the most important initial stages before oil palm becomes a productive crop in the field. Good nursery growth will also produce good plant growth in the field (Pascual et al. 2018). In the process of its growth, oil palm requires the same intensity of sunlight as that needed by plants for good seed growth by providing radiant intensity. According to (Williamson et al. 2020), irradiation protects the oil palm seedlings from direct sunlight and helps retain moisture. The use of irradiation aims to adjust the percentage of light intensity received to meet plant needs (Metsoviti et al. 2019).

The light intensity required by the oil palm plant is around 40% during the first three to four months of the nursery. On the other hand, in the oil palm nursery technical guidelines, the sun exposure rate for oil palm plants is 100% between the ages of 1 and 1.5 months, 50% between the ages of 1.5 and 2.5 months, and 0% after the age of 2. 5 months (Abubakar, Ishak, and Makmom 2022). Simalungun variety is used. The Simalungun cultivar is native to North Sumatra which has an equatorial rain pattern with an average annual rainfall of 2,227.7 mm, while South Kalimantan has a moosun mm rain pattern, with an average annual rainfall of 2,437.1 solar radiation. North Sumatra averages 45,573 W/m2 per year. In contrast to South Kalimantan's average solar radiation per year, which is 52,994 Wm-2.

Because South Kalimantan has more rainfall and sunshine than North Sumatra, the difference in rainfall and sunlight is needed to provide optimal sunlight so that North Sumatra's native oil palm can grow well in South Kalimantan. in the nursery.

2. Materials and Methods

This research was conducted in the Moonsun area in Kotabaru District from November 2020 to January 2021. The materials consisted of DxP Simalungun oil palm sprouts, ultisol soil, paranet, SP36 fertilizer, Urea fertilizer, NPK fertilizer. While the tools in this study were polybags, hoes, sieves, scales, rulers, cameras, stationery.

The environmental design used was a single factor Completely Randomized Design (CRD) with 5 treatments, namely p0 = control of seedlings aged 1.5 months with an intensity of 0% or 0 Wm-2, until the age of 1.5-2.5 months with an intensity of 50% or 26.497 Wm-2, and until age> 2.5 months 100% or 52.994 Wm-2, p1 = seedlings aged 1.5 months 25% or 13.248 Wm-2, aged 1.5-2.5 months 25% or 13.248 Wm -2, age >2.5 months 100% or 52.994 Wm-2, p2 = seedlings 1.5 months old 25% or 13.248 Wm-2, 1.5-2.5 months old 50% or 26.497 Wm-2, age >2.5 months 75% or 39.745 Wm-2, p3 = seedlings 1.5 months old 25% or 13.248 Wm-2, 1.5-2.5 months old 75% or 39.745 Wm-2, age >2 .5 months 100% or 52.994 Wm-2, p4 = 1.5 months old seedlings 50% or 26.497 Wm-2, 1.5-2.5 months old 75% or 39.745 Wm-2, >2.5 months old 100% or 52.994 Wm-2. The experimental unit consisted of 5 treatments x 4 replications or 20 experimental units, each consisting of 9 polybags.

The stages of this research include land preparation, planting media, shading preparation, implementation, observation. Meanwhile, the observed parameters included seedling height, number of leaves, length of leaf blade, stem diameter and relative growth rate.

Testing the homogeneity of observational data with the Bartlett test. Data transformation is performed if there is an inhomogeneity and then analysis of variance is performed with a 95% confidence interval. Test further with the Honest Significant Difference Test (BNJ).

3. Results and Discussions

1. Stem Diameter

Data from the research on radiation intensity on stem diameter at 12 WAP can be seen in Table 1.

Table 1
Effect of radiation intensity on stem diameter (mm) at 12 WAP

Treatment	Stem diameter(mm)
p_0 = (0%, 50%, 100%)	6.58 b
p_1 = (25%, 25%, 0%)	8.42a -
p_2 = (25%, 50%, 75%)	8.63 a
p_3 = (25%, 75%, 0%)	9.02a -
p_4 = (50%, 25%, 0%)	8.55a -

Note: The mean number followed by the same letter is not significantly different based on the BNT test at the 5% level

Table 1 shows that the maximum stem diameter at 12 weeks with p3 treatment was 9.02 mm (25%, 75%, 0%). This treatment was not significantly different from other radiation intensity treatments and all radiation intensity treatments were significantly different from the control (no radiation intensity). (Mutale-Joan et al. 2020) suggested that the growth in plant diameter is closely related to the rate of photosynthesis. Diameter grows faster in the open than in the shade, so that plants growing in the open tend to be shorter, thus forming (Kothari, Montgomery, and Cavender-Bares 2021). (Desta and Amare 2021) found that the inhibition of stem diameter was caused by a lack of stimulation aspects of sunlight as a product of photosynthesis and hormonal activity in the formation of meristematic cells in the direction of stem diameter, especially because the light intensity was too low. However, at the point of light saturation, plants cannot increase their photosynthetic output as light increases. Higher temperatures increase transpiration, which is reflected in, among other things, lower relative humidity. If it lasts long enough it can disrupt the water balance of plants and reduce plant growth, including plant diameter.

2. Leaf Length

Data from the research results of giving the percentage of radiation intensity to the length of leaves aged 8 WAP can be seen in Table 3.

Table 2
The effect of the percentage of radiation intensity on leaf blade length (cm) at 8 WAP

Treatment	Leaf length
p_0 = (0%, 50%, 100%)	9.81a –
p_1 = (25%, 25%, 0%)	9.55 ^{ab}
p_2 = (25%, 50%, 75%)	9.55 ^{ab}
p_3 = (25%, 75%, 0%)	10.30 $^{a.m}$
p_4 = (50%, 25%, 0%)	8.90 ^{b}

Note: The mean number followed by the same letter is not significantly different based on the BNT test at the 5% level.

Table 2 shows that the longest leaf blade length at 8 weeks of age was 10.30 cm in the p3 treatment (75%, 25%, 0%). This treatment was not significantly different from other radiation intensity treatments except for the p4 treatment. It has been hypothesized that radiation levels at p3 are optimal for the development of leaf blade length in oil palm nurseries.

In his research, (Abaza et al. 2020) suggested that paranet irradiation treatment showed a significant response to leaf length, with leaves that were shaded longer than without irradiation (direct sunlight). Plants that grow in low to full light intensity. Hence, the leaves are longer, but thinner.

Differences in radiant intensity affect light intensity, air temperature, humidity, and soil temperature in the plant environment, so that differences in light intensity received by plants affect the availability of light energy to be converted into heat and chemical energy (Nikkanen and Rintamäki 2019).

4. Conclusion

Treatment of the percentage of radiation intensity has an influence on the diameter of the stem age, the number of age leaves, the length of the leaf blade age.

Percentage of radiation intensity of oil palm in treatment p3 = (25%, 75%, 0%) is better than control p0 = (0%, 50%, 100%).

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