e-ISSN: 2985-4415
DOI: 10.57254/irma.v1i4.48

International Research of Multidisciplinary Analysis
IRMA JOURNAL
Vol. 1, No. 4, April, 2023 hal. 361-480
Journal Page is available at http://irma.nindikayla.com/index.php/home

WATER VOLUME TREATMENT FOR THE GROWTH OF OIL PALM SEEDLINGS (*ELAEIS GUINEENSIS* JACQ) FROM TWIN MAIN NURSERIES IN ULTISOL SOIL

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ABSTRACT

Oil palm seeds that come from twin sprouts are very sensitive to the need for water, if it is too late to provide water, the plant seeds will respond immediately resulting in the plant seeds withering, drying out over time and eventually dying. This study aims to determine the effect of giving water with different volumes on the growth of oil palm seedlings from twins in ultisol soil. This study used a completely randomized design (CRD) and the treatment design was rice husk charcoal with 4 treatment levels including; P_1: Giving 500 ml of water, P_2: Giving 400 ml of water, P_3 Giving 300 ml of water, P_4: Giving 200 ml of water. Data were analyzed using analysis of variance, followed by Duncan's Multiple Range Test (DNMRT) at α level of 5%. The results showed that the volume of water given at doses of 500 ml, 400 ml, 300 ml and 200 ml had no significant effect on plant height, fresh weight and root dry weight of twins of oil palm (*Elaeis guineensis* Jacq) seedlings. The P3 treatment with a volume of 300 ml of water showed a high yield of 65.33 cm oil palm plants, which exceeded the normal growth standards for oil palm seedlings.
Keywords: *Water Volume, Oil Palm Seeds from Twins, Ultisol.*

INTRODUCTION

Indonesia is an agricultural country, has the opportunity to develop oil palm plants more effectively. It has been proven that in 2019 Indonesia's oil palm plantation area reached 14,456,611 hectares, with a total production of 47,120,247 tonnes. If percentaged, the average production of oil palm plantations only reaches 3.2 tonnes/ha. (Central Bureau of Statistics 2019). Most of the oil palm plantations are managed by large private companies with an area of 7,942,336 hectares. People's Plantation occupies the second position in its contribution to the total area of Indonesian oil palm plantations, which is 5,896,775 hectares, while a small portion is managed by State Large Plantations , namely 579,501 hectares (Ditjenbun 2020). Indonesia's CPO production increased from 31 million tonnes in 2015 to 49.71 million tonnes in 2021 or an increase of 18.71 million with a productivity of 3,947 kg/ha in the last 5 (five) years (Ditjenbun 2021).

The productivity of oil palm is strongly influenced by the cultivation techniques applied. Oil palm cultivation activities include nurseries, land clearing, planting, maintenance, harvesting and post-harvesting. One aspect of maintaining oil palm plants that needs to be considered in oil palm cultivation activities is one of the nurseries. The increase in the area of oil palm plantations continues to increase every year, so it is necessary to procure seeds in large quantities and with good quality. Nurseries are one of the determining factors for oil palm cultivation. Oil palm nurseries are the first step that will determine the success of planting in the field (Sayahfitri, 2007).

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Nursery is a process for forming and developing seeds into seeds that are ready for planting. For most types of plants, including oil palm, the nursery process is necessary because it is seen as far more profitable than planting directly in the field. Seeding can be done in one stage or two stages. Two-stage nurseries are considered more appropriate, namely pre-nursery and main nursery (Mangunsoekarjo and Semangun, 2008). One of the stages of developing an oil palm plantation is the nursery. Nursery is work to prepare quality plant material to meet the needs of planting areas or is a process to grow and develop seeds or seeds into seeds that are ready to be planted in the field.

Palm oil producers generally sell seeds in the form of seeds that have germinated. Sometimes oil palm seeds can be single or twin sprouts (multi embryos). Three types of multi-embryonic seeds exist: twins, triplets, and quadruplets. Multi-embryonic seeds are an advantage for seed buyers. Multi-embryonic seeds can cover seeds that are damaged during delivery and abnormal seeds. The number of twin sprouts can reach about 5% of the total distribution of seeds (Syamsuddin, 1997). Unfortunately, many do not know about oil palm nurseries as with these twin seedlings. Farmers think twin seeds are abnormal seeds that must be discarded, even though the existence of such seeds is an advantage for the farmers themselves because they get two seeds from one sprout and can save costs. Several sprouts have 2 or 3 buds in one bag of sprouts, often called "twin sprouts". The mistakes farmers often make in handling seeds from twin sprouts are not separating or even throwing away the seeds from the twin sprouts.

Seedlings derived from twin sprouts are very sensitive to the need for water. Therefore, if it is too late to provide irrigation water, the plant seeds will respond immediately. As a result, the plant seeds will wither, dry out over time and eventually die. Water requirements (amount and quality) must be determined before starting site preparation, so existing water sources can meet the required needs. According to Darmawan (2006), several supporting factors affecting seed quality are planting material, planting media, planting techniques, maintenance, watering, and fertilization.

Oil palm is a plant with shallow or fibrous roots, so it is susceptible to drought stress. The causes of plants experiencing drought include high transpiration, followed by limited groundwater availability during the dry season. Oil palm is a plant with shallow or fibrous roots, so it is susceptible to drought stress. The causes of plants experiencing drought include high transpiration, followed by limited groundwater availability during the dry season. Drought stress in plants can be caused by a lack of water supply in the root area and excessive water demand by the leaves due to evapotranspiration rates that exceed the rate of water absorption even though the soil water is sufficiently available (Levitt, 1980).

One way to stimulate the growth of oil palm seedlings is to provide growing media by considering aeration and water availability. Oil palm is a plant that has shallow roots (fibrous roots), making it susceptible to drought stress. The causes of plants experiencing drought include high transpiration followed by limited availability of ground water during the dry season. (Dwiyana et.al., 2015). Sufficient water to meet plants' water needs is very important. Maryani (2012) stated that in conditions of soil water content above field capacity, growth will be slow due to inhibition of root development caused by a lack of oxygen in the soil. If the amount of water available in the soil is small, it will cause the plants to wilt. When the water supply is insufficient, the plant will experience water stress, then transpiration and assimilation will decrease. In addition to providing water, the environment affects plant growth. The water that can be absorbed from the soil by plant roots is called available water, which

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is the difference between the amount of water in the soil at field capacity (water stored in the soil that does not flow due to gravity) and the amount of water in the soil at the percentage of permanent wilting (the percentage of moisture at which plants grow). will wilt and not freshen up in an atmosphere of 100% relative humidity.

Oil palm is a plant that requires large amounts of water. Sukamto (2008) explained that the water requirement for oil palm pre-nursery is 25-50 ml daily. Water availability is one of the main limiting factors for the growth of oil palm. Experiencing a lack of water in the planting medium causes plants to experience growth disturbances and can cause death. Salisbury and Ross (1997) stated that sufficient water to meet plants' water needs is very important. The role of water in plants is as a solvent for various organic molecular compounds (nutrients) from the soil to the plant, transporting photosynthate from the source to the sink, maintaining cell turgidity including cell enlargement and opening of stomata, as the main constituent of protoplasm and temperature control for plants. If the availability of ground water is lacking for plants, as a result, water as a raw material for photosynthesis and transportation of nutrients to the leaves will be hampered, which will have an impact on the resulting production.

The water needs of oil palm plants are different in each growth phase. In the early phase of the nursery (Pre-Nursery), the average amount of water needed for routine watering every day is around 0.2-0.3 liters per seedling, while for the Main Nursery it takes about 8 mm/day or about 2-3 liters per seedling. For irrigation systems that are usually used in nurseries, the average water level is 10 mm/day (Turner and Gillbanks, 2003). Hidayatulllah and Sudiarso (2019) stated that watering 1 time on oil palm seedlings was not significantly different from watering 2 times and 3 times per day. Therefore it is more efficient if you only use watering at a rate of 1 time per day, namely 500 ml of water. The treatment of 75% soil + 25% compost can substitute 100% soil media because it has the same results based on other test results.

Ultisol soil or red yellow podzolic soil is an infertile soil used in agriculture. It is characterized by the accumulation of clay in the subsurface horizon, thereby reducing water absorption and increasing runoff and soil erosion. Ultisol constraints regarding soil physics, chemistry and biology, are low to moderate organic matter, high Al acidity, low N, P, K nutrient content, CEC values (Cation Exchange Capacity) and Base SaturationN is low and very sensitive to erosion. Even though ultisol soil has poor chemical properties, if proper soil management is carried out, the soil will play an optimal role. Ultisols have a very low organic matter content, showing a yellowish-red soil color, acidic soil reactions, low base saturation, high Al levels, and low productivity levels. The texture of this soil is loamy to sandy loam, with a high bulk density between 1.3-1.5g/cm3. Ultisol soil has macro nutrients such as phosphorus and potassium which are often deficient and are the properties of Ultisol soil which often inhibit plant growth (Andalusia, 2016).

METHODS

This research was conducted at Kebun Pijoan, Campus II, Batanghari University. The tools needed are hoes, scales, tape measure, ruler, pens, books, cameras, ovens, knives, polybags measuring 40 x 50 cm with a thickness of 0.2 mm, paranet, ultra violet plastic, wood, nails, saws, hammers, machetes, ropes, buckets, mineral bottles, measuring cups. Materials needed for Sampurna Agro oil palm seeds from twins aged 3 months, water as treatment, topsoil, fertilizer N-P-K (16-16-16). The experiment was carried out for 3 months, using a completely randomized design (CRD) and the treatment design was rice husk charcoal with 4 treatment levels

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including; P1: Giving 500 ml of water, P2: Giving 400 ml of water, P3 Giving 300 ml of water, P4: Giving 200 ml of water. Data were analyzed using analysis of variance, followed by Duncan's Multiple Range Test (DNMRT) at α level of 5%. This research was repeated 3 times so that the number of experimental plots was 12 and each experimental plot consisted of 2 plants and 1 plant was observed as a sample so that the total number of plants was 24.

Parameters measured were Plant Height (cm), Root Dry Weight (g), Plant Dry Weight (g). To see the effect of the treatments being tried, the data obtained were analyzed statistically using analysis of variance, then continued with the DNMRT test at α level of 5%.

RESULTS AND DISCUSSION

The analysis of variance showed that giving water with different volumes had no significant effect on the height of the oil palm plants. The DNMRT follow-up test at the 5% level for each treatment is shown in Table 1.

Table 1. The average height of oil palm plants in various water treatments with different volumes at week 12.

Treatment	Average plant height (cm)
P3 (300 ml)	65,33 a
P4 (200 ml)	63,76 a
P1 (500 ml)	62,23 a
P2 (400 ml)	62,03 a

Note: Numbers followed by the same lowercase letters are not significantly different in the DNMRT follow-up test at level *a* = 5%

Table 1 shows that treatment P3 produced the highest average plant height, namely 65.33 cm, this result was not significantly different when compared to treatments P1, P2 and P4. The lowest average plant height was in the P2 treatment, namely 62.03 cm. This study showed that in the P3 treatment with a volume of 300 ml, the growth of oil palm seedlings from twins met the standard compared to the normal growth of oil palm seedlings, namely 64.3 cm. This condition indicates that twin seedlings can be used for planting in the field. Syamsuddin (1997) reported that genetically twin seeds from multi-embryonic seeds can be used provided they meet the growth criteria according to standards.

The analysis of variance showed that giving water with different volumes had no significant effect on the fresh weight of the oil palm plants (Appendix 3). DNMRT follow-up test at 5% level for each treatment can be seen in Table 3.

Table 3. The average fresh weight of oil palm shoots at various doses of water with different volumes until the 12th week.

Treatment	Average Plant Wet Weight (g)
P1 (500)	255,78 a
P2 (400)	206,91 a
P3 (300)	200,55 a
P4 (200)	199,77 a

Note: Numbers followed by the same lowercase letters are not significantly different in the DNMRT follow-up test at level *a*=5%

Table 3 shows that treatment P1 produced the highest average fresh weight of plant stem, namely 255.78 g, this result was not significantly different when compared

e-ISSN: 2985-4415
DOI: 10.57254/irma.v1i4.48

to treatments P2, P3 and P4. The lowest result was obtained in the P4 treatment which was 199.77 g.

The analysis of variance showed that giving water with different volumes had no significant effect on the dry weight of the roots of the oil palm plants (Appendix 4). DNMRT follow-up test at 5% level for each treatment can be seen in Table 4.

Table 4. Average dry weight of oil palm roots at various doses of water with different volumes at week 12.

Treatment	Average Dry Weight of Roots (g)
P2 (400 ml)	12,98 a
P4 (200 ml)	12,49 a
P1 (500 ml)	12, 19 a
P3 (300 ml)	9,81 a

Note: Numbers followed by the same lowercase letters are not significantly different in the DNMRT follow-up test at level *a*=5%

Table 4 shows that the P2 treatment produced the highest average dry weight of plant roots, namely 12.98 g, this result was not significantly different when compared to treatments P1, P3 and P4. The lowest average dry weight of plant roots was found in the P3 treatment, namely 9.81 g. The results showed that administering water volume treatment to oil palm seedlings from twins had no significant effect on plant height, fresh weight of stalk and dry weight of roots. The research results are still above the growth standards of oil palm seedlings (plant height can reach 65.33 cm). These conditions illustrate that optimal water availability still provides adequate nutrient availability for plants.

This shows that twin seedlings can be used for planting in the field. Syamsuddin (1997) reported that genetically twin seeds from multi-embryonic seeds can be used provided they meet the growth criteria according to standards. Giving water to plants should be by the real needs of plants, because a lack or excess of water gives an unfavorable effect on plants. Water is an important factor for plants. Apart from being a raw material for photosynthesis, water acts as a solvent, reagent in various reactions and as a maintainer of plant turgor. Gardner et al (1991) explained that increasing height occurs due to an increase in the number of cells and cell size. Plants that experience a deficit (lack) of water, turgor in plant cells becomes less than the maximum, as a result nutrient absorption and cell division are hampered. Conversely, if plants' water needs can be optimised, plant growth will be maximized because photosynthate production can be allocated to plant organs. Fitter et al (1998) explained that the disruption of protein and chlorophyll biosynthesis due to water stress affects plant growth rate.

The analysis showed that giving several volumes of water on the fresh weight of the fraction had no significant effect. This was shown in the 400 ml P1 treatment which produced the highest average fresh weight of plant stems, namely 255.783 g, this result was not significantly different when compared to treatments P2, P3 and P4. The 200 ml P4 treatment obtained the lowest result, 199.77 g. Dwijosapoetro, (1986) states that adding nutrients to the soil can increase the fresh body weight while also increasing the growth of roots, stems and leaves so that the wet body weight increases.

The analysis of variance showed that giving water with different volumes had no significant effect on the dry weight of the roots of the oil palm plants. Gardner et al

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(1991) explained that when plants experience a deficit (lack of) water the plant will experience a decrease in the rate of photosynthesis. Apart from being allocated to be stored in the organs, some of the photosynthates are broken down to synthesize dissolved organic compounds to reduce cell osmotic potential (osmoregulation) so that plants can survive in drought conditions so that their dry weight is reduced. The greater the dry weight accumulation in plants, it illustrates that these plants also have a high growth rate. This is because plant dry weight results from photosynthate assimilation which is translocated from the roots to all parts of the plant (Salisbury and Ross, 1997). Heddy (2001) states that plant dry weight results from protoplasmic addition due to the increase in the size and number of cells. According to Nyakpa et al (2014), increasing chlorophyll will increase photosynthetic activity, resulting in more assimilate and increasing plant dry weight.

Jumin (1992), states that water deficit conditions can reduce the turgidity of plant cells. Decreasing the turgidity of plant cells can inhibit the multiplication and enlargement of plant cells. Water stress also causes nutrient transport and plant biochemical processes to be disrupted, the low plant dry weight value indicates this. Hanafiah (2005), states that the water absorption rate by roots will be lower if the soil water content approaches the permanent wilting point coefficient. Permanent wilting point is a condition in which the availability of soil water content is lower than the needs of plants for activity and maintaining cell turgor, so that plants become permanently wilted or unable to recover. This occurs due to limited water supply, even though water absorption by plants and evaporation processes continue. In this condition, the only remaining water is adhesion and cohesion water firmly bound by the soil matrix force, which is at a stress of around 15 atm.

CONCLUSIONS

Based on research and data analysis it can be concluded that . Based on the results of the study, it can be concluded that the volume of water given at doses of 500 ml, 400 ml, 300 ml and 200 ml had no significant effect on plant height, fresh weight and root dry weight on oil palm seedlings (Elaeis guineensis Jacq) from twins. The P3 treatment with a volume of 300 ml of water showed that the height of the oil palm plant was 65.33 cm, which exceeded the normal growth standard for oil palm seedlings.

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