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Increasing The Growth Of Oil Palm Seeds by Administering Various Types and Dosages of Organic Fertilizer in The Main Nursery

Jogi Andre Rigel, Neny Andayani*, Erick Firmansyah
INSTIPER Yogyakarta
Jln Nangka II Maguwoharjo Sleman Yogyakarta, Indonesia
*Email : neny_and@instiperjogja.ac.id

ABSTRACT

Oil palm seedlings can be grown using either organic or inorganic fertilization; however, organic fertilization is more environmentally beneficial. This study seeks to determine the impact of organic fertilizer type and dosage on the growth of oil palm seedlings in the main nursery. This investigation employed a two-factor factorial experimental method arranged in a completely randomized design (CRD). The form of organic fertilizer consists of three levels: banana stems, water hyacinth, and manure. The second factor is the organic fertilizer dosage, which consists of three levels: 100g, 250g, and 300g. Five repetitions yielded nine treatment combinations and one control treatment (plants without organic fertilizer) from these treatments. Observations included plant height, leaf count, stem diameter, fresh crown weight, dried shoot weight, root length, fresh root weight, dry root weight, and root volume. The results demonstrated a significant interaction between the type and dosage of organic fertilizer on the parameters of plant height, root length, shoot fresh weight, root fresh weight, and root volume. The combination that yields the greatest results is 300 grams of manure. Applying organic fertilizer in varying quantities results in superior plant growth compared to the control (without organic fertilizer).

Keywords: *oil palm, organic fertilizer, types of organic fertilizer, organic fertilizer dosage, main nursery*

1. INTRODUCTION

The area of oil palm plantations in Indonesia in 2020 is 14.5 million hectares (ha) and will increase to 14.6 million hectares (ha) in 2021, with a comparison of 54.69% community-owned plantations, 41.44% privately owned plantations, and 3.88% state-owned plantations. Indonesia is estimated to produce 44.76 million tonnes of CPO per year (BPS, 2020). Many company-owned and privately-owned plantations are undergoing revitalization, necessitating large quantities of seedlings. Fertilization is frequently neglected in nurseries, resulting in sub-optimal seedling growth.

Oil palm plant nurseries with a two-stage or double-stage system are carried out in two stages, namely, the initial nursery or the pre-nursery. This stage is carried out for three months, after three months, the seedlings are transferred to the main nursery or what is often referred to as the main nursery. This stage is carried out until the seedlings are 12 months old and ready to be planted in the field (Rizki, 2018). In primary nurseries, seedlings are cared for by hydrating, fertilising, and controlling pests. Both organic and inorganic fertilizers can be used for Fertilization (Andri & Wawan, 2017). Currently, organic-based fertilizers are beginning to replace chemical fertilizer s. Chemical fertilizers will result in soil compaction, which degrades the soil's physical and biological properties. This is one of the reasons why chemical fertilizers are giving way to organic-based fertilizers. The use of organic fertilizers can increase the quality of agricultural output and prevent soil degradation. (Rastiyanto *et al*., 2013).

Organic-based fertilizers generally come from the remaining parts of humans, animals, and plants. An example is manure, which is a fertilizer derived from livestock manure. Such as cow manure, goat manure, and chicken manure (Simanullang *et al.*, 2019).

The use of organic fertilizers is one method to address the issue of reliance on inorganic fertilizers. In addition to being environmentally friendly, using organic fertilizers can enhance the soil's chemical, physical, and biological properties, thereby increasing soil fertility (Roidah, 2013). Other organic fertilizers derived from organic detritus include banana stems and water hyacinth, the latter of which frequently contributes to water pollution.

Cow dung has a high fibre content, such as cellulose, as measured by the C/N ratio of>40. Additionally, cow dung contains macronutrients such as 0.5 N, 0.25 P2O 5 0, 5% K2O with a water content of 0.5% and other essential microelements (Hafizah & Mukarramah, 2017; Parnata, 2010). Important elements found in banana stems include nitrogen (N), phosphorus (P), and potassium (K). Bahtiar et al. (2017) found that banana weevil contains 14.89% carbon, 1.05% nitrogen, 0.04% phosphorus, and 0.76% potassium. Ismayanti et al. (2020) determined that water hyacinth plants contained 78.47% organic matter, 21.23 % C-organic, 0.28 % total N, 0.0011 % total P, and 0.01 % total K. Adnan et al. (2015) found that adding 36 g of organic matter per polybag increased the plant height, number of fronds, stem diameter, and total P of oil palm seedlings in the primary nursery. Various organic materials that positively influence the growth of oil palm seedlings in main nurseries require additional testing. The appropriate dosage must also be determined depending on the composition of various elements. This study aimed to ascertain the effect of organic fertilizer type and dosage on the growth of oil palm seedlings in the main nursery.

2. MATERIAL AND METHODS

From November 2022 to February 2023, the research was conducted in the INSTIPER Education and Research Garden (KP-2) in Banjeng Village, Wedomartani District, Sleman Regency, Yogyakarta. This investigation utilized three-month-old oil palm seedlings (pre-nursery seeds) of the DxP Simalungun variety obtained from the Medan Oil Palm

Research Centre (PPKS), banana stem compost, water hyacinth, manure, 40 cm x 40 cm polybags, regosol soil, and water. This investigation employed a two-factor factorial experimental method arranged in a completely randomized design (CRD). The first variable is the form of organic fertilizer, which has three levels: banana stems, water hyacinth, and manure. The second variable is the organic fertilizer concentration, which consists of three levels: 100 g, 250 g, and 300 g. From the initial treatment, nine therapies were derived, resulting in 9 x 5 = 45 possible combinations plus one control treatment (without organic matter). The number of repetitions was five, resulting in the use of fifty plants.

Making banana stem and water hyacinth compost is done by chopping the banana stems and water hyacinth into small parts, then placing it in a prayer cloth and mixing EM4 10 ml/1 liter of water, after that it is mixed thoroughly and this process lasts for 1 month and every 2 weeks back and forth so that the compost ripening process is perfect. Manure already in finished form (already decomposed)

Before being placed in polybags, the planting media consists of regosol soil that has been filtered through a 2-millimeter sieve and then mixed with compost material, with the type of compost and the dosage determined by the treatment. Three months before the experiment was conducted, seeds were planted. Three-month-old seedlings are transplanted into media containing various treatments and amounts of organic matter. Then, irrigate your plants each morning and evening. Manual weed control consists of removing vegetation from polybags or around polybags.

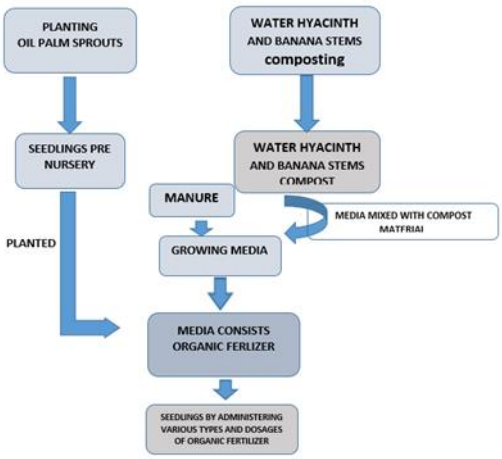

Figure 1. Research implementation diagram

3. RESULT AND DISCUSSION

The collected data were analyzed using variance at a significance level of 5%. The variance analysis revealed a significant interaction between compost types and dosages on seedling height, shoot fresh weight, root length, root fresh weight, root dry weight, and root volume. The average data are displayed in Tables 1 and 2.

Table 1. The type and dose of organic fertilizer influenced average seedling height, crown fresh weight, and root length.

Types of Treatment and Dosage	Seed Height (cm)	Header fresh weight (g)	root length (cm)
Control	34,38f	24,80g	35,02f
Cow manure dose of 100 g	38,80e	38,00e	47,18d
Cow manure dose of 250 g	44,48b	54,00b	60,32b
Cow manure dose of 300 g	48,12a	57,60a	70.16a
Banana stem dose 100 g	37,56e	27,60g	43,70e
Banana stem dose 250 g	43,26bc	33,60f	48,50d
Banana stem dose 300 g	41,84cd	41,80d	50,08c
Water hyacinth dose of 100 g	40,60d	37,80f	44,54e
Water hyacinth dose of 250 g	43,24bc	37,80e	51,34c
Water hyacinth dose of 300 g	41,34d	45,00c	70,06a

Note: The mean followed by the same letter in the same column shows no significant difference based on the DMRT at the 5% test level

The seedling height and fresh weight of shoots in the combination treatment of cow manure at a dose of 300 g were greater than in the other treatment combinations, as shown in Tables 1 and 2. The average treatment combination of compost fertilizer types and amounts differed substantially from the control. In accordance with the opinion (Prasetya 2014) that cow manure can have a significant effect on the vegetative and generative growth of oil palm plants, adding cow manure to the soil can enhance its structure and meet the plant's nutrient requirements, specifically in the form of N P K. Sufficient nitrogen content in plants facilitates plant growth, particularly in the stems and foliage. Plants require nitrogen for the formation of cells.

Table 2. Average fresh weight of roots, dry weight of roots, and volume of roots which are affected by the type and dose of organic fertilizer.

Types of Treatment and Dosage	Root fresh weight (g)	Root dry weight (mg)	Root Volume (cm^3)
Control	18,80f	34,38 f	11,40d
Cow manure dose of 100 g	21,00e	38,80 e	19,20c
Cow manure dose of 250 g	33,60b	44,48 b	20,40bc
Cow manure dose of 300 g	37,80a	48,12 a	25,80a
Banana stem dose 100 g	22,60e	37,56 e	19,00c
Banana stem dose 250 g	29,00c	43,26 bc	20,40bc
Banana stem dose 300 g	31,60b	41,84 cd	21,80b
Water hyacinth dose of 100 g	25,20d	40,60 d	19,40c
Water hyacinth dose of 250 g	27,00cd	43,24 bc	21,00bc
Water hyacinth dose of 300 g	32,40b	41,34 d	25,20a

Note: The mean followed by the same letter in the same column shows no significant difference based on the DMRT at the 5% test level

The treatment with manure at a dose of 300 g and water hyacinth at a dose of 300 g yielded the greatest results according to the root length parameter during the growth of oil palm seedlings in the main nursery. According to Yahumri (2015) in (Sakti & Sugito, 2018), organic fertilizer is essential for improving soil conditions, specifically by reducing soil compaction so roots can easily extend out and search for nutrients. If the roots assimilate nutrients effectively, it will positively affect the leaves and stems as they provide food sources for the plant.

The parameters of fresh weight and dry weight of roots in the growth of oil palm seedlings in the main nursery showed that the application of manure at a dose of 300 g gave the best average. It is suspected that manure at a dose of 300 g meets the needs of nitrogen (N), phosphorus (P), and potassium (K) elements in the growth of oil palm seedlings in the main nursery. It also contains micronutrients such as calcium, magnesium, and manganese. Manure also has an effect for a long time. According to Kaswinarni & Nugraha (2020), the application of cow manure has a good effect on vegetative growth, which will increase the weight of the roots and help absorb nutrients in the soil. On the canopy fresh weight parameter in the growth of oil palm seedlings in the main nursery, it was shown that manure application at a dose of 300 g gave the best results compared to other treatments. According to Darmawan et al. (2020), the nutrient composition of manure can play a good role in the growth of stems and leaves so that the process of providing food for plants is sufficient, and this affects the fresh weight of the canopy

in a combination of manure with a dose of 300 g better.

On the root volume metric, the combination of 300 g of manure and 300 g of water hyacinth compost yielded the highest mean value compared to the other combinations. Ratriyanto et al. (2019) report that applying organic fertilizers to plants has a positive effect on the plants and the soil provided with these organic nutrients, where organic matter improves the soil's physical, chemical, and biological properties.

The variance analysis revealed that there was no significant interaction between the type and dose of compost on the stem diameter of oil palm seedlings in the primary nursery and that the type and dose of compost had no effect on stem diameter. The average treatment combination of compost types and amounts differed markedly from the control. The mean values are shown in Table 4.

Table 3. Average stem diameter affected by the type and dose of organic fertilizer (mm)

Macam/dosis	100 g	250 g	300 g	Average
cow manure	24.42	27.48	29.48	27.12a
banana stem	21.12	23.90	25.26	23.42c
water hyacinth	22.08	24.24	26.34	24.22b
Average	22.54r	25.20q	27.02p	24.92 x
Control Average				18.58 y

Note: The mean followed by the same letter in the row or column shows no significant difference at the 5% test level

Applying fertilizer can produce better results than composting banana stems or water hyacinths on the criterion of stem diameter. It is suspected that manure contains more organic matter than other composts. This conforms to the assertion (Hartatik & Widowati, 2006). The optimum stem diameter parameters were found at a dose of 300 g. According to (Rakhmawati et al., 2019), high doses of organic fertilizers will produce the greatest results for plants. Still, this conclusion must be supported by information regarding the nutrient needs of plants. There was no significant interaction between the type and dosage of compost and the number of leaves; however, both the type and dosage of compost significantly affected the number of leaves. The average treatment combination of compost types and amounts differed markedly from the control. The mean values are shown in Table 4.

Table 4. The average number of leaves affected by the type and dose of organic fertilizer (strands)

Type/dose	100 g	250 g	300 g	Average
cow manure	9,00	9,40	10,00	9,47a
banana stem	8,80	9,00	9,40	9,07b
water hyacinth	8,40	8,80	9,20	8,80b
Average	8,73q	9,07q	9,53p	9,11 x
Control Average				8,00 y

Note: The mean followed by the same letter in the row or column shows no significant difference at the 5% test level

On the metric of number of leaves, the application of manure at a dose of 300 g yielded favorable results. According to (Mayun, 2007), the administration of manure can influence the growth of plant leaves. This is likely due to the presence of macronutrients, specifically nitrogen, which aids in leaf formation. Good leaf growth will result in an efficient photosynthetic process during the stages of plant nutrition production. And in terms of leaf yield, the combination of species and doses was markedly superior to the control treatment.

Table 5. Average canopy dry weight affected by the type and dose of organic fertilizer (mg)

Type/dose	100 g	250 g	300 g	Rerata
cow manure	11,60	15,20	18,20	15,00a
banana stem	10.60	13.80	16.20	13.53b
water hyacinth	11.40	14.00	15.20	13,53b
Average	11.20r	14.33q	16.53p	14,02 x
Control Average				8,20 y

Note: The mean followed by the same letter in the row or column shows no significant difference at the 5% test level

The canopy dry weight parameter (Table 5) indicates that the greatest results were obtained with 300 g of manure. Supposedly, nitrogen fertilizer promotes plant growth. This is consistent with the assertion (Hafizah & Mukarramah, 2017) that nitrogen plays a role in stimulating plant growth, particularly stems, roots, and foliage, so that it can aid in photosynthesis. According to Astutik et al. (2019), providing potassium and phosphorus nutrients to plants will increase vegetative development, specifically plant roots, and adding water hyacinth compost and manure to the soil will increase root growth. Good roots will support the photosynthesis process so that the plant's water and nutrient requirements are met, which will positively affect the plant's height, weight, and leaf count. Adnan et al. (2015) state that organic fertilizer applied to plants will yield the greatest results.

4. CONCLUSION

Based on the findings of the research and analysis conducted, the following conclusion can be drawn:

1. There is a significant interaction between the types and amounts of organic fertilizer used on the parameters of seedling height, root length, crown fresh weight, root fresh weight, root dried weight, and root volume.
2. The application of 300g of manure positively affected all growth parameters of oil palm seedlings in the primary nursery.
3. Combining organic fertilizer varieties and amounts is superior to the control treatment.

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