Agro Bali : Agricultural Journal
Vol. 3 No. 1: 74-83, June 2020
e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

APPLICATION OF COW MANURE, UREA AND NPK FERTILIZER COMBINATION ON THE GROWTH OF PALM OIL (*Elaeis guineensis* Jacq) IN PRE-NURSERY

Heri Setyawan[1], Sri Manu Rohmiyati[2], Jhon Hardy Purba[3]

[1]Akademi Komunitas Perkebunan Yogyakarta, Jl. Petung 2, Depok, Sleman,Yogyakarta,55281
[2]Institut Pertanian Stiper Yogyakarta, Jl. Nangka 2, Depok, Sleman,Yogyakarta,55282
[3]Universitas Panji Sakti, Jl. Bisma 22, Singaraja, Bali 81117
Email: herisetyawan@akpy-stiper.ac.id

Abstract. Seedling performance is a prerequisite for successful palm oil cultivation. Determining the growth of seedlings in addition to genetic factors can also be influenced by the provision of nutrients at the beginning of growth. This research was conducted with the aim to get the best combination of cow manure with urea and NPK on the growth of oil palm seedlings in pre-nursery. This experiment used a factorial design, consisting of a single factor arranged in a completely randomized design (CRD), which is a combined application of cow manure, urea fertilizer and NPK fertilizer consisting of 4 combination levels (0.4 g urea + 0.4 g NPK; 0.2 g urea + cow manure fertilizer, 0.2 g NPK + cow manure fertilizer, and 65 g cow manure fertilizer). Research data was analyzed using Analysis of Variance (ANOVA) at 5% significance level. The results showed that administration of a combination of 0.2 g urea + 40 g cow manure produced the best growth of oil palm seedlings, although it had the same effect as a combination of 0.4 g NPK fertilizer + 50 g cow manure, whereas the combination treatment of 0.4 g urea + 0.4 g NPK fertilizer and 65 g cow manure treatment resulted in lower growth of oil palm seedlings.
Keywords: root weight, seed weight, fertilizer combination, plant height, root volume.

INTRODUCTION

Palm oil (Elaeis guineensis Jacq) is a plantation crop commodity in Indonesia which has the largest area of land and production compared to other plantation crops. Data from the Central Statistics Agency, Statistics of Indonesian Oil Palm Plantations in 2018, the total area of oil palm plantations in Indonesia is 12,761,586 ha with details of community plantations reaching 5,811,785 ha, the area of plantations owned by the state through State-Owned Enterprises (BUMN) reaches 593,619 ha, and private company oil palm land covering an area of 6,356,182 ha (Badan Pusat Statistik, 2018).

In line with the growing domestic and international demand for palm oil, the need to increase Indonesian palm oil production is by routine fertilization which is carried out every six months according to fertilizer recommendations. Furthermore, to increase Indonesia's palm oil production in the long run, there is a need to improve the quality of oil palm plants where quality palm oil plants come from excellent and superior seeds. Superior seeds were obtained from various studies and experiments conducted.

Superior palm oil seedlings can be produced from nurseries with good growing media and can provide sufficient nutrients for seedling growth. NPK fertilizer dosage treatment however did not significantly affect the growth of oil palm seedlings in the main nursery (Purba, 1992). A good growing media comes from the soil with a combination of organic fertilizer and inorganic fertilizer. Many organic materials come from animal waste which is usually called manure. According to (Nurhakim, 2014) suggested that manure has the main benefit of being able to maintain the physical structure of the soil so that roots can grow well, one type of organic material that is commonly used is manure. According to (Purba et al., 2018), organic fertilizers also have benefits in providing media for the life of beneficial

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

microorganisms for soil fertility and reducing porosity in sandy soil and helping aeration in clay soils.

Manure includes organic fertilizer derived from livestock manure. Manure can be either solid or liquid. Manure has properties as a soil enhancer and can provide nutrients, both macro and micro (Meng et al., 2016; Muhereza et al., 2020; Sri Nuryani, 2010). There are several types of manure, namely chicken, goat or cow manure. Manure that is commonly used is cow manure (Yuliana et al., 2015). cow manure contains a variety of nutrients needed by plants, including 3% N, 2% P2O5, 1% K2O and C / N (Gilroyed et al., 2013; Sanni, 2016)

METHOD

This study uses a single completely randomized design (CRD). The treatments given are as follows: K1 = (0.4 g urea + 0.4 g NPK), K2 = (0.2 g urea + cow manure fertilizer), K3 = (0.2 g NPK + cow manure fertilizer), K4 = (65 g cow manure). From these treatments obtained four treatment combinations and each treatment combination was repeated eight times, so the number of plants used for this study was 4 x 8 = 32 oil palm seedlings.

The observations made were quantitative observations by measuring plant growth divided into 7 parameters, namely seed height, number of leaves, fresh weight of seedlings, dry weight of seeds, fresh weight of roots, root dry weight, root volume. Research data were analyzed using Analysis of Variance (ANOVA) at 5% significance level. If there is a real difference, further testing was done using the Duncan Multiple Range Test using SPSS.

RESULTS AND DISCUSSION

The results of the analysis showed that the application of various combinations of organic fertilizers and inorganic fertilizers, influence on plant growth and development on the growth of oil palm seedlings (*Elaeis guineensis* Jacq) in pre-nursery. From the results of this study showed a real impact on the growth of oil palm seedlings, where the real influence of the growth of oil palm seedlings was shown in parameters plant height, plant fresh weight, plant dry weight, root fresh weight, root dry weight and root volume, whereas the number of leaves does not show tangible results. The results of the analysis are presented and discussed in the figure below.

Seedling Height

The treatment of urea fertilizer (0.2 g) + cow manure fertilizer (40 g), and NPK fertilizer combination (0.2 g) + cow manure (50 g) significantly influences the growth of oil palm seedling height. Duncan Multiple Range Test (DMRT) test results can be seen in Figure 1.

Based on Figure 1 it can be seen that the combination of urea fertilizer (0.2 g) + cow manure (40 g), and the combination of NPK fertilizer (0.2 g) + cow manure (50 g) produces the highest seedling height. This refers to the combination of urea fertilizer (0.2 g) + cow manure (40 g), and the combination of NPK fertilizer (0.2 g) + cow manure (50 g) is the most optimum fertilizer combination needed by coconut seeds palm oil in pre-nursery. This happened because cow manure, urea fertilizer and NPK fertilizer can provide macro and micronutrients in sufficient quantities in balance for plant growth and development.

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

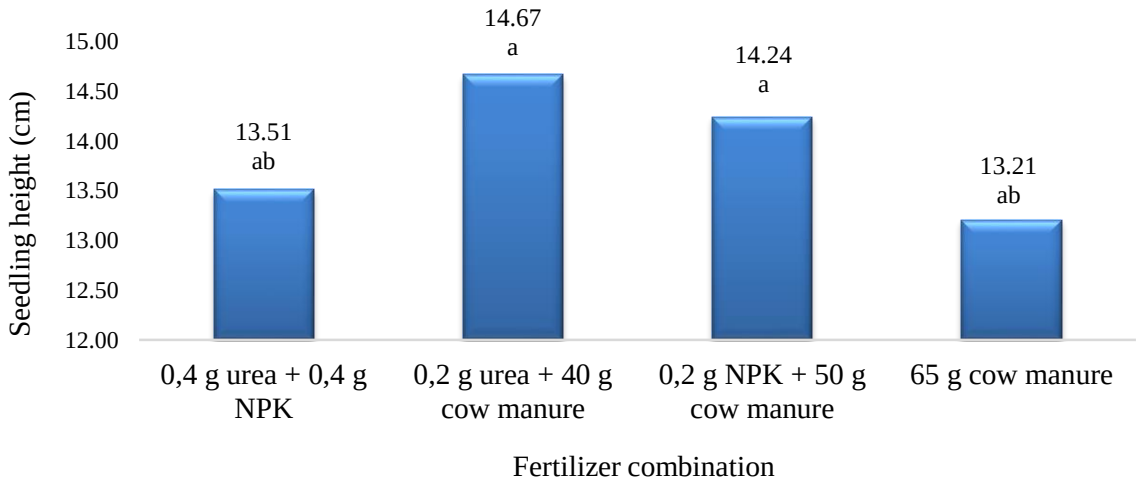

Figure 1. Application of a combination of cow manure, urea fertilizer, and NPK fertilizer to the height of oil palm seedlings in pre-nursery.
Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

The nutrient has a vital role for plants, namely as a source of nutrients for plant growth. Nutrients were divided into two types, namely macronutrients and micronutrients. Macronutrients are nutrients needed by plants in large quantities, including Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg). Micronutrients are nutrients needed by plants in small quantities, including iron (Fe), manganese (Mn), boron (B) and copper (Cu). Nutrient N contained in NPK and urea fertilizers significantly influence the growth of oil palm seedlings in pre-nursery. The P element acts as an energy source that helped plants in the vegetative phase, where the P element also influences the growth of oil palm seedling height. Element K functions as a protein maker, a catalyst in cell and carbohydrate division, and helps the development of root growth. Sulfur (S), Calcium (Ca) micronutrients are available in the planting medium and can be absorbed by plants for vegetative growth of plants.

However, the combination of organic fertilizer and inorganic fertilizer did not show a significant effect on the number of leaves of oil palm seedlings, as shown in Figure 2.

Number of Leaves

Data from observations on the parameters of the number of leaves of oil palm seeds, after an analysis, showed that the application of a combination of organic and inorganic fertilizers did not significantly affect the number of leaves of oil palm seedlings. Duncan Multiple Range Test DMRT test results can be seen in Figure 2.

Based on Figure 2 it can be seen that the combination of organic and inorganic fertilizers shows almost the same number of leaves, with the average value of the fertilizer combination being as follows: K1 = 3.09, K2 = 3.29, K3 = 3.25, and K4 = 3.1. Then visually seen the number of leaves also there is no real difference. According to (Buntoro et al., 2014) suggested that the leaves are the main plant organs to absorb sunlight. Wide leaves can absorb more

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

sunlight, while what happens in the nursery of oil palms in the pre-nursery is that the leaf surface is still narrow so that it cannot absorb more sunlight for photosynthesis. Pre-nursery nurseries are conducted within three months so that the plants are still small and have not been maximized in the growth of the number of leaves, so the average number of leaves in the nursery pre-nursery is almost the same. But it is different from the fresh weight of oil palm seeds, where the fresh weight of the seeds shows significantly different results. Can be seen in Figure 3.

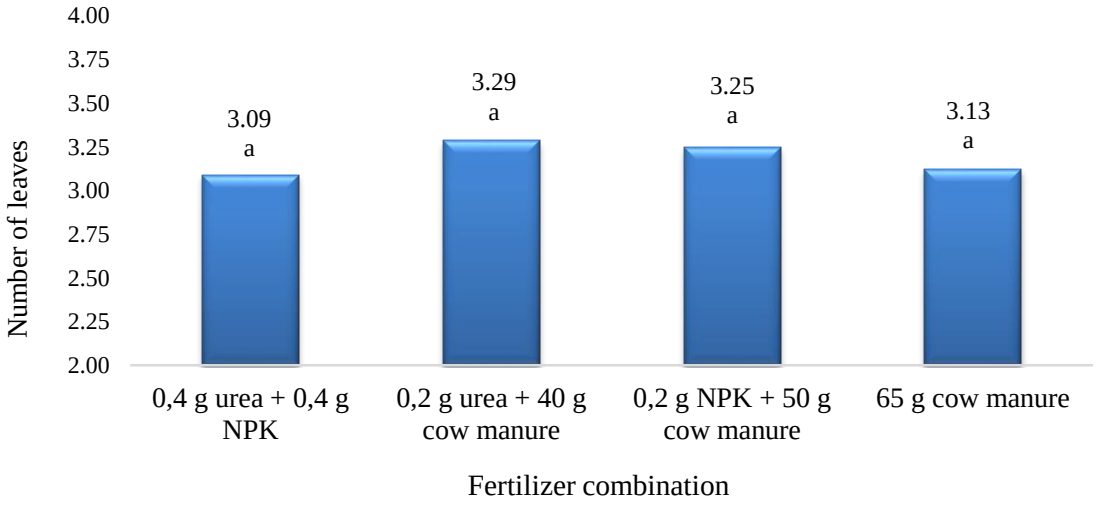

Figure 2. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the number of palm oil seedling leaves in a pre-nursery.
Note: The diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

Seedling Fresh Weight

Data analysis of the parameters of fresh weight of oil palm seeds, showed that the combined treatment of urea fertilizer (0.2 g) + cow manure fertilizer (40 g), and NPK fertilizer combination (0.2 g) + cow manure fertilizer (50 g) significantly affected the fresh weight of oil palm seedlings. Duncan Multiple Range Test DMRT test results can be seen in Figure 3.

Based on Figure 3 it can be seen that the application of urea fertilizer combination (0.2 g) + cow manure fertilizer (40 g) gave the highest fresh weight of seeds compared to other fertilizer combinations, with an average value in treatment K2 = 9.71, the value is highest compared with other fertilizer combinations. Furthermore, the second-highest value was in the K3 treatment = 9.22, where the K3 treatment was not significantly different from the K2 treatment. Then in treatment K4 = 6.95, the number showed results that are significantly different from treatment K2 but not significantly different from treatment K3. Then the treatment K1 = 6.43 showed the lowest value compared to other fertilizer treatments where the K1 treatment showed significantly different values from the K2 and K3 treatments, but not significantly different from the K4 treatment.

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

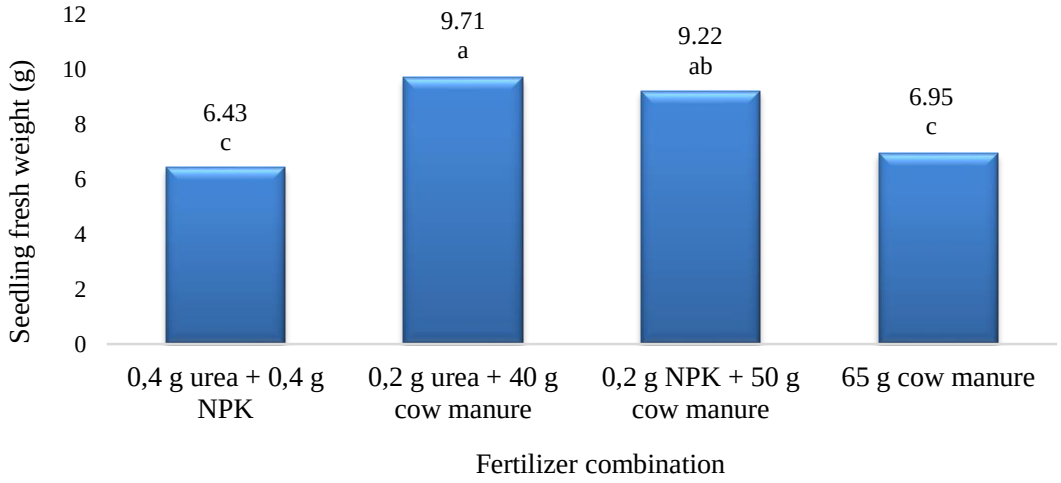

Figure 3. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the fresh weight of oil palm seeds in pre-nursery.
Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

According to Ardiansyah et al., (2014), the availability of nutrients is a factor that can give effect to the development and growth of plants, thus giving effect to the fresh weight of plants. Mayani et al. (2015) suggested that the increase in plant wet weight is inseparable from the increase in nutrients such as potassium, phosphorus, and nitrogen where potassium influences the development of meristem tissue that can affect the length and width of leaves. Phosphorus plays a role in activating enzymes in photosynthesis and the element nitrogen influences the formation of new cells.

Furthermore, for the combination of urea fertilizer (0.4 g) + NPK fertilizer (0.4 g) into the lowest value fertilizer combination, this is supported by (Lakitan, 2007) suggesting that too high concentrations of essential nutrients can cause imbalances absorption of other nutrients in the process of plant metabolism.

Seedling Dry Weight

Data analysis of observations on the parameters showed that the combined treatment of urea fertilizer (0.2 g) + cow manure (40 g) significantly affected the dry weight of oil palm seedlings and showed weight dry is the highest compared to other fertilizer combinations. Duncan Multiple Range Test DMRT test results can be seen in Figure 4.

Based on Figure 4, it can be seen that the combination of urea fertilizer (0.2 g) + cow manure (40 g) has a significant effect on the dry weight of oil palm seedlings. Seed dry weight reflects the accumulation of organic compounds that plants have successfully synthesized from inorganic compounds, especially water and carbon dioxide. Nutrients that have been absorbed by the roots contribute to the increase in dry weight of plants (Suryaningrum et al., 2016). Seed dry weight in the combined treatment of urea fertilizer (0.2 g) + cow manure (40 g) is the effect of the accumulation of organic and inorganic fertilizers that are successfully absorbed by plants well. Nutrient content in urea

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

fertilizer and cow manure are able to support photosynthesis and transpiration processes so that the utilization of a nutrient combination of urea fertilizer (0.2 g) + cow manure fertilizer (40 g) is more efficient and has a significant effect on the dry weight of oil palm seedlings.

Roots Fresh Weight

Data from observations on the parameters of fresh weight of oil palm roots, after an analysis, showed that the combined treatment of urea fertilizer (0.2 g) + cow manure (40 g) significantly affected the fresh weight of oil palm roots. Duncan Multiple Range Test DMRT test results can be seen in Figure 5.

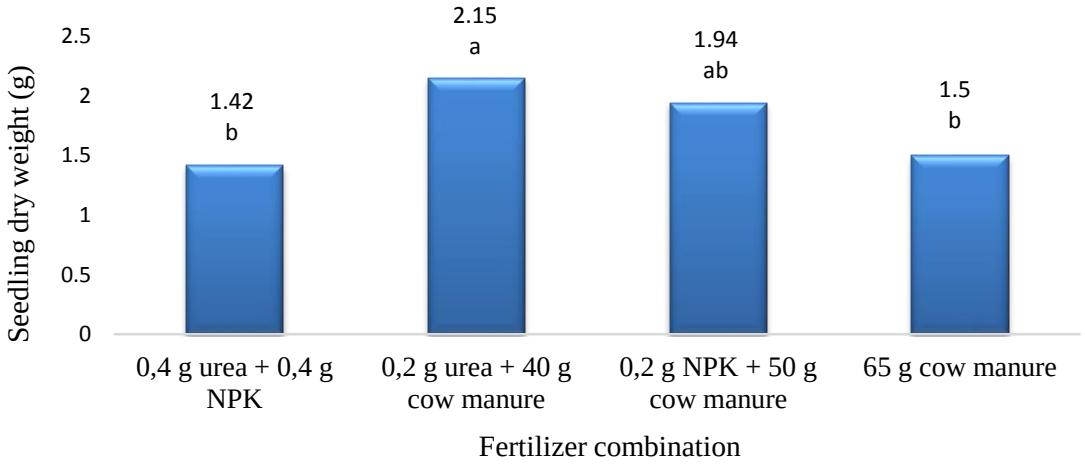

Figure 4. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the dry weight of oil palm seedlings in pre-nursery.
Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

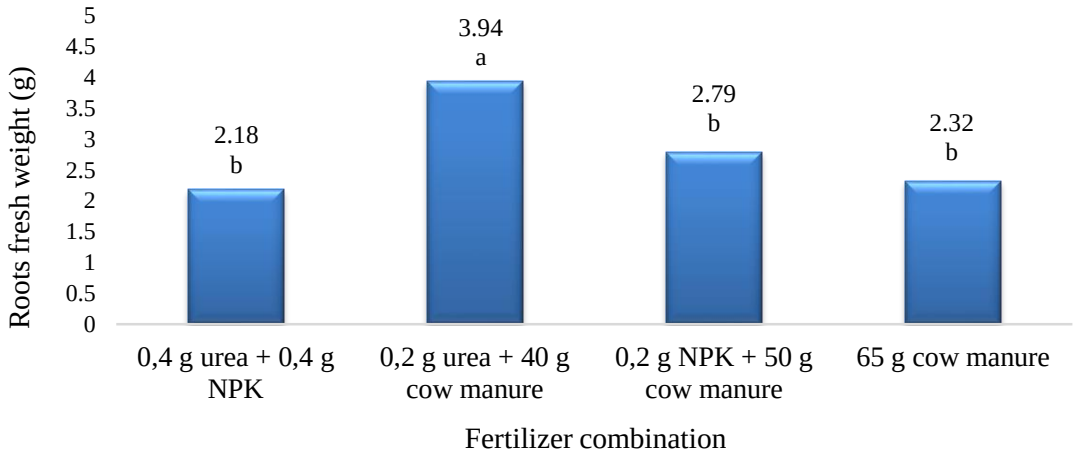

Figure 5. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the fresh weight of oil palm seedling roots in a pre-nursery.

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

Based on Figure 5, it can be seen that the combination of urea fertilizer (0.2 g) + cow manure (40 g) gave the highest fresh root weight compared to other fertilizer combinations.
Planting in a polybag with a size appropriate to the age of the plant provides space for the roots to absorb water optimally. Roots that have a high fresh weight value are a starting point for fulfilling water needs (Febriyono et al., 2017). In this study, watering is done twice in one day, morning and evening. According to (Lubis, 2008) the best rainfall for oil palm is 2,000 - 2,500 mm/ year. Water needs per staple for oil palm seedlings in the pre-nursery nursery is 0.1-0.3 litres per day, so the water needs in this nursery are very fulfilled. Furthermore, the combination of urea fertilizer (0.4 g) + NPK fertilizer (0.4 g) gave the lowest fresh root weight. It is suspected that the combination of the two inorganic fertilizers causes excessive dosage, which results in palm oil seedlings not being able to grow properly due to the absence organic fertilizer that can provide the balance of nutrients needed by plants.

Roots Dry Weight

Data of observations on the parameters of dry weight of oil palm roots, after an analysis, showed that the combined treatment of urea fertilizer (0.2 g) + cow manure (40 g) significantly affected the dry weight of oil palm roots. Duncan Multiple Range Test DMRT test results can be seen in Figure 6.

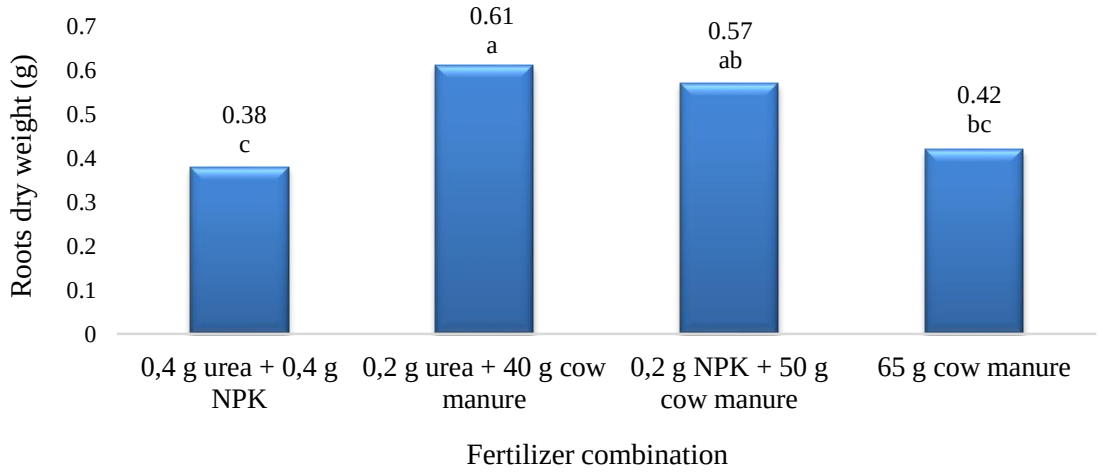

Figure 6. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the dry weight of the roots of oil palm seeds in a pre-nursery.
Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

Based on Figure 6 it can be seen that the application of urea (0.2 g) fertilizer combination with cow manure (40 g) produces the highest root dry weight compared to other fertilizer combinations. Root dry weight is the weight of the root after drying through a process of the oven

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

at 70^{o} C for 72 hours until the weight is constant (Sinaga, 2008).

The fresh weight of roots is directly proportional to the dry weight of roots, roots that have high fresh weight are likely to have high dry weight. This is possible because there are sufficient supporters of the growth of oil palm seeds such as sunlight, nutrients, minerals, and water so that the root growth is equally reflected in the dry weight of the roots. The application of organic matter can increase the root dry weight because it can make the soil structure become loose. It is said that beef manure fertilizer has an influence on the dry weight of the roots of oil palm seeds in pre-nursery.

Root dry weight in combination treatment of urea fertilizer (0.2 g) cow manure (40 g) showed significantly different results showing the same results in the analysis of root volume measurements can be seen in Figure 7.

Roots Volume

Data of observations on the parameters of the volume of oil palm roots, after an analysis showed that the combined treatment of urea fertilizer (0.2 g) + cow manure (40 g) and NPK fertilizer combination (0.2 g) + cow manure fertilizer (50 g) significantly affect the volume of oil palm roots. Duncan Multiple Range Test DMRT test results can be seen in Figure 7.

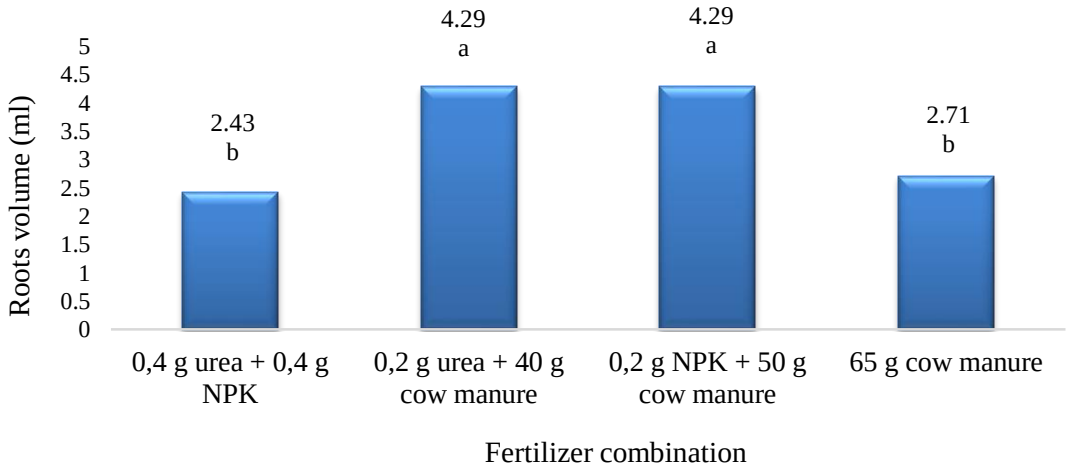

Figure 7. Application of a combination of cow manure, urea fertilizer, NPK fertilizer to the root volume of oil palm seedlings in pre-nursery.
Note: the diagram followed by the same letter shows no significant difference based on the DMRT test at 5% level.

Based on Figure 7 it can be seen that the combination of urea fertilizer (0.2 g) + cow manure (40 g) and NPK fertilizer combination (0.2 g) + cow manure fertilizer (50 g) showed the highest average root volume with the same value compared to other fertilizer combinations.

The best interaction treatment is on the combination treatment of urea fertilizer (0.2 g) + cow manure fertilizer (40 g) and NPK fertilizer combination (0.2 g) + cow

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

manure fertilizer (50 g) where the root volume produced is 4, 29 cm3 and the lowest treatment is in the treatment of urea fertilizer (0.4 g) + NPK fertilizer (0.4 g).

According to (Rachmawati D, 2016), the application of biological fertilizers can provide excellent growth in plant height, number of leaves, canopy width, root length, and weight per plant. So it can be interpreted that the cow manure fertilizer in combination gives a real effect on the volume of roots in the nursery of oil palms in the pre-nursery.

CONCLUSION

Based on the analysis of the results of research and discussion, it can be concluded that the combined treatment of urea (0.2 g) + cow manure (40 g) gives the best effect on seedling height, fresh weight, dry weight, root fresh weight, dry weight roots and root volume in pre-nursery nurseries compared to other fertilizer combinations.

REFERENCES

Ardiansyah, M., Mawarni, L., & Rahmawati, N. (2014). Respons Pertumbuhan dan Produksi Kedelai Hasil Seleksi terhadap Pemberian Asam Askorbat dan Inokulasi Fungi Mikoriza Arbuskular di Tanah Salin. *Jurnal Online Agroteknologi*, *2*(3), 948–954. https://doi.org/10.1017/CBO9781107415324.004

Badan Pusat Statistik. (2018). *Statistik Kelapa Sawit Indonesia*.

Buntoro, B. H., Rogomulyo, R., & Trisnowati, S. (2014). Pengaruh Takaran Pupuk Kandang dan Intensitas Cahaya Terhadap Pertumbuhan dan Hasil Temu Putih (Curcuma zedoaria L.). *Vegetalika*, *3*(4), 29–39. https://doi.org/https://doi.org/10.22146/veg.5759

Febriyono, R., Susilowati, Y. E., & Suprapto, A. (2017). Peningkatan Hasil Tanaman Kangkung Darat (Ipomoea reptans, L.) melalui Perlakuan Jarak Tanam dan Jumlah Tanaman per Lubang. *Jurnal Ilmu Pertanian Tropika Dan Subtropika*, *2*(1), 22–27. http://jurnal.untidar.ac.id/index.php/vigor/article/view/323/257

Gilroyed, B. H., Li, C., Reuter, T., Beauchemin, K. A., Hao, X., & McAllister, T. A. (2013). Influence of distiller's grains and condensed tannins in the diet of feedlot cattle on biohydrogen production from cattle manure. *International Journal of Hydrogen Energy*, *30*, 1–9. https://doi.org/10.1016/j.ijhydene.2013.07.014

Lakitan, B. (2007). *Fisiologi Pertumbuhan dan Perkembangan Tanaman*. Raja Grafindo Persada.

Lubis, A. U. (2008). *Kelapa Sawit (Elaeis guineensis Jacq) di Indonesia Edisi ke-2*. Pusat Penelitian Kelapa Sawit.

Mayani, N., Kurniawan, T., & Marlina. (2015). Pertumbuhan Tanaman Kangkung Darat (Ipomea reptans Poir) Akibat Perbedaan Dosis Kompos Jerami Dekomposisi Mol Keong Mas. *Lentera*, *15*(13), 59–63.

Meng, Q. F., Li, D. W., Zhang, J., Zhou, L. R., Ma, X. F., Wang, H. Y., & Wang, G. C. (2016). Soil properties and corn (Zea mays L.) production under manure application combined with deep tillage management in solonetzic soils of Songnen Plain, Northeast China. *Journal of Integrative Agriculture*, *15*(4), 879–890. https://doi.org/10.1016/S2095-3119(15)61196-0

Muhereza, I., Pritchard, D., Murray-prior, R., & Collins, D. (2020). Nitrogen

e-ISSN 2655-853X
DOI: 10.37637/ab.v3i1.419

value of stockpiled cattle manure for crop production. *African Journal of Agricultural Research*, *16*(5), 574–584. https://doi.org/10.5897/AJAR2020.14718

Nurhakim, Y. I. (2014). *Perkebunan Kelapa Sawit Cepat Panen*. Infra Pustaka.

Purba, J. H. (1992). Pengaruh Pemotongan Biji dan Pemberian Dosis Pupuk Rustika Yellow terhadap Pertumbuhan Vegetatif Bibit Kelapa Sawit (Elaeis Guineensis Jacq.) di Main Nursery. *Skripsi.* Universitas Sumatera Utara (USU). Medan.

Purba, J. H., Parmila, I. P., & Sari, K. K. (2018). Pengaruh Pupuk Kandang Sapi dan Jarak Tanam terhadap Pertumbuhan dan Hasil Kedelai (Glycine max L. Merrill) Varietas Edamame. *Agro Bali: Agricultural Journal*, *1*(2), 69–81.

Rachmawati D, K. E. (2016). Kajian Penggunaan Pupuk Hayati untuk Mengendalikan Penyakit Akar Gada (Plasmodiophora brasiccae) pada Tanaman Sawi Daging. *Agrivigor*, *9*(1), 67–72.

Sanni, K. O. (2016). Effect of compost, cow dung and NPK 15-15-15 fertilizer on growth and yield performance of Amaranth (Amaranthus hybridus). *International Journal of Advances in Scientific Research*, *2*(3), 76–82. https://doi.org/10.7439/ijasr

Sinaga, R. (2008). Keterkaitan nisbah tajuk akar dan efisiensi penggunaan air pada rumput gajah dan rumput raja akibat penurunan ketersediaan air tanah. *Jurnal Biologi Sumatra*, *3*(1), 29–35.

Sri Nuryani, M. H. dann N. W. Y. (2010). Serapan Hara N, P, K pada Tanaman Padi Dengan Berbagai Lama Penggunaan Pupuk Organik pada Vertisol Sragen. *Jurnal Ilmu Tanah Dan Lingkungan*, *10*(1), 1–13.

Suryaningrum, R., Purwanto, E., & Sumiyati. (2016). Analisis Pertumbuhan Beberapa Varietas Kedelai pada Perbedaan Intensitas Cekaman Kekeringan. *Agrosains*, *18*(2), 33–37.

Yuliana, Rahmadani, E., & Permatasari, I. (2015). Aplikasi pupuk kandang sapi dan ayam terhadap pertumbuhan dan hasil tanaman jahe (Zingiber officinale Rozc) di media gambut. *Jurnal Agroteknologi*, *5*(2), 37–42.