EFFECT OF CARBONTILISER FERTILIZER AND INORGANIC FERTILIZER IN BEACH SAND MARGINAL SOIL ON THE GROWTH OF OIL PALM (Elaeis Guineensis Jacq) SEEDS IN PRE NURSERY

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***Abstract*— This study aimed to determine the effect of doses of Carbontiliser fertilizer and NPK inorganic fertilizer on beach sand marginal soil on the growth of oil palm seedlings (Elaeis Guineensis) in the Pre Nursery which was conducted at KP 2 INSTIPER Yogyakarta from March to April 2022. The study was conducted using factorial pattern experiment method consisting of 2 factors arranged in a Completely Randomized Design (CRD). The first factor is the dose of carbontiliser fertilizer consisting of 4 levels, namely control C0 (0 g), C1 (50 g), C2 (75 g) and C3 (100 g) The second factor is the dose of NPK fertilizer consisting of 4 levels, namely control N0 (0 g) , N1 (15 g), N2 (30 g), N3 (45 g) repeated 4 times to obtain 4 x 4 = 16 treatment combinations, each treatment combination was repeated 4 times to obtain 16 x 4 = 64 experimental units. The research data were analyzed using ANOVA (Analysis of variance) with a significant level of 5%. If there is a significant difference, proceed with Duncan's multiple range test or DMRT (Duncan Multiple Range Test) with a real level of 5%. The results of variance showed that there was a significant interaction with the growth of oil palm seedlings (Elaeis Guineensis) in marginal soil of beach sand on the parameters of number of leaves, soil pH, total nitrogen content, available phosphorus content, available potassium content and C – soil organic.**

Keywords— Carbontiliser, NPK, Beach Sand Marginal Soil, Pre Nursery oil palm seeds

I. INTRODUCTION

One of the mainstay commodities of plantation crops that have an important role is oil palm (Elaeis Guineensis) which is expected to increase farmers' income. Some of the main factors that affect the productivity of oil palm plants are using superior and quality seeds. Because investing in a plantation is a seed that will be planted, because it is a source of future income. One of the actions of seed selection, maintenance is a closely related mechanism. (Bintoro et al., 2014)

Carbontiliser fertilizer is a fertilizer made from coal. From a chemical perspective, this fertilizer is an alkaline aluminosilicate mineral with a pH of 8-12 and contains nutrients such as Mg, Ca, Na, Si, Fe, Al, S, P and K which can increase the pH. acid soil because it is used as a supplement so that the soil structure can be improved. (Febriana, 2019).

The characteristics of sandy soil are loose structure, low nutrients, low cation exchange capacity, low water capacity, high soil temperature, very high wind and evaporation rates and good permeability. Therefore beach sand has marginal properties in terms of soil structure, water holding capacity, soil chemistry and soil organic matter (Ma'ruf, 1998).

To add nutrients, NPK fertilizer is added, the nutrients are arranged in a composition of 16-16-16. These nutrients along with others cause microbes to multiply in the soil, while organic microbes can increase C in the soil (Mukhtaruddin et al., 2015).

II. RESEARCH LOCATION

This research was conducted at INSTIPER Yogyakarta KP2 Field, Wedomartani Village, Depok, Sleman, Yogyakarta Special Region in March – June 2022 with an altitude of 180 meters above sea level.

III. METHOD

In this research the tools used were: hoe, bamboo, cutlery, polybag, paranet, Ph meter, analytical balance, plastic clip, oven, 500 ml capacity measuring cup, digital caliper, ruler, brown envelope with string and Leaf Area Meter (LAM. Materials used: beach sand soil, carbontiliser fertilizer, Mutiara NPK fertilizer (16:16:16) and DxP Yangambi oil palm seeds.

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IV. RESULTS AND DISCUSSION

The results of the variance were further tested with the Duncans Multiple Range Test (DMRT) at the 5% level of significance.

Table 1. The Effect of Carbontiliser and NPK Fertilizers on the Number of Leaves.

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	6.25 a	5.25 abc	5.00 abc	5.75 abc
15 g	5.75 abc	5.50 abc	5.75 abc	4.75 bc
30 g	5.25 abc	6.00 ab	5.50 abc	5.75 abc
45 g	6.00 ab	4.50 c	5.00 abc	6.00 ab

Information:
The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 14.85%
(+)

Table 1 shows that the doses of carbontiliser fertilizer and NPK fertilizer doses have a real interaction with the growth of the number of leaves of oil palm seedlings in the pre-nursery. In the control treatment, the combination of carbontiliser fertilizer with a dose of 0 g and NPK fertilizer with a dose of 0 g gave the highest number of leaves.

Table 2. Effect of Carbontiliser and NPK fertilizers on soil pH

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	5.67 bc	5.55 bc	5.57 bc	6.38 a
15 g	5.59 bc	5.44 bc	5.45 bc	5.55 bc
30 g	5.56 bc	5.54 bc	5.31 c	5.53 bc
45 g	5.36 c	5.73 bc	5.89 b	5.61 bc

Information:
The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 6.36%
(+)

Table 2 shows that the administration of doses of carbontiliser fertilizer and doses of NPK fertilizer gave a real interaction with the growth of the number of leaves of oil palm seedlings in the pre-nursery. The combination of 0 g NPK and 100 g Carbontiliser treatment showed the highest soil Ph value of 6.38.

Table 3. Effect of Carbontiliser Fertilizer and NPK on Total N

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	0.02 ghi	0.05 ab	0.04 bcd	0.05 abc
15 g	0.03 afg	0.03 def	0.04 cde	0.04 bcd
30 g	0.02 fgh	0.04 cde	0.05 bc	0.06 a
45 g	0.02 i	0.03 efgh	0.02 fghi	0.02 hi

Information:

The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 40.61%
(+)

Table 3 shows that the doses of carbontiliser fertilizer and NPK fertilizer doses have a significant interaction with total soil nitrogen content. The combination of 30 g NPK and 100 g Carbontiliser treatment showed the highest soil available nitrogen content, namely 0.06%.

Table 4. Effect of Carbontiliser Fertilizer and NPK on Available P

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	5.68 i	20.23 h	22.98 fg	25.30 ef
15 g	20.20 h	25.58 e	27.58 e	30.80 d
30 g	25.55 e	25.33 ef	21.05 gh	22.75 g
45 g	75.83 b	71.23 c	74.18 b	122.40 a

Information:
The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 77.93%
(+)

Table 4 shows that the doses of carbontiliser fertilizer and NPK fertilizer doses have a significant interaction with total soil phosphorus levels. The combination of 45 g NPK and 100 g Carbontiliser treatment showed the highest soil available phosphorus content, namely 122.40 ppm.

Table 5. Effect of Carbontiliser and NPK Fertilizers on Available K

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	59.35 ab	44.85 cd	48.43 bcd	59.08 ab
15 g	43.80 d	48.40 bcd	55.33 abc	64.23 a
30 g	64.35 a	59.65 ab	66.45 a	54.73 abcd
45 g	57.28 ab	65.25 a	62.75 a	49.85 bcd

Information:
The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 16.89%
(+)

Table 5 shows that the doses of carbontiliser fertilizer and NPK fertilizer doses have a significant interaction with soil available potassium levels. The treatment combination of 30 g NPK and 75 g Carbontiliser, 45 g NPK and 50 g Carbontiliser, 30 g NPK and 0 g Carbontiliser, 15 g NPK and 100 g Carbontiliser showed the highest soil available potassium levels, respectively 66.45 me/100g Soil, 65.25 me/100g Soil, 64.35 me/100g Soil, 64.23 me/100g Soil, which was not significantly different from 45 g NPK and 75 g Carbontiliser, namely 62.75 me/100g Soil.

Table 6. Effect of Carbontiliser and NPK Fertilizers on C – Organic Soil

NPK	Carbontiliser			
	0 g	50 g	75 g	100 g
0 g	0.48 c	0.59 bc	0.57 bc	1.38 a
15 g	0.64 bc	0.53 c	0.58 bc	0.79 bc

30 g	0.86 bc	0.71 bc	0.92 bc	0.75 bc
45 g	0.49 c	0.66 bc	0.62 bc	0.70 bc

Information:
The mean number followed by the same letter shows a significant difference according to the results of the 5% DMRT test.
Coefficient of Variation (CV) : 41.86%
(+)

Table 6 shows that the doses of carbontiliser fertilizer and NPK fertilizer doses have a significant interaction with soil C – organic content. The combination of 0 g NPK and 100 g Carbontiliser treatment showed the highest soil C – Organic soil content, namely 1.38%. While the lowest C-Organic soil content resulted from a combination of 45 g NPK and 0 g Carbontiliser treatment and without treatment (control) each soil C-Organic content was 0.49% and 0.48%, which were not significantly different from the 15 g NPK treatment combination and 50 g of Carbontiliser which is 0.53%.

The combination that produced the highest number of leaves was the combination of 0 g NPK and 0 g Carbontiliser, namely 6.25 palm oil leaves. According to (Sunardi, 2007) the sand of the Samas beach of Bantul has several chemical characteristics with an elemental content of 2.6% nitrogen, 100.8 ppm phosphorus, 0.6% potassium, 1.2% Mg and 2.7% Ca. This shows that the nutrients in the beach sand soil are sufficient for the growth and development of oil palm fronds in the Pre Nursery.

The best Ph was 6.38 resulting from a combination of 0 g NPK and 100 g Carbontiliser. It is known that the Ph has increased, this is because the carbontiliser fertilizer contains 7% dolomite which plays a major role in neutralizing the Ph of beach sand soil, the application of this fertilizer is able to increase the concentration of OH- ions resulting in an increase in Ph. This is because organic fertilizers are able to release minerals in the form of basic cations (Ca, Mg, Na, K). According to (Lestari et al., 2007) said that the soil needs to be given dolomite to increase soil Ph and increase the availability of Ca elements in the soil. Soil Ph can be increased by applying coal fertilizer because humic acid contains chelate compounds that can bind cations and can hold NH4+ and K+ ions in the soil.

The best nitrogen content was found in the combination treatment of 30 g NPK and 100 g carbontiliser, which was 0.06% in the soil. This is because the application of NPK fertilizer of 30 g and 100 g of Carbontiliser is able to add nitrogen nutrients to beach sand soil, so that the application of these two fertilizers becomes a booster contributing nitrogen to the soil. In accordance with the statement (Intan et al., 2013) states that the presence of high nitrogen nutrient content is caused by the high percentage of nitrogen and organic matter contained in the fertilizer. This organic material is a source of organic colloids that are able to supply macro or micro elements, prevent toxic metal elements, have the ability to hold water, increase CEC, and serve as a food source for soil microbes. Carbontiliser fertilizer also has the properties of Controlled Release Fertilizer (CRF) or controlled release of nutrients, CRF itself includes a solid matrix that has functions such as a selective barrier and active ingredients. The active ingredient in question is the active ingredient that is coated or inserted by a barrier so that the speed of its release can be controlled. (Piluharto et al., 2014) so that the N content given to the soil can be maximally absorbed by plant roots.

The best soil Phosphor content was 122.40 ppm resulting from a combination of 45 g NPK and 100 g Carbontiliser treatment. This is because the applied NPK and Carbontiliser fertilizers have a relatively high total P element of 0.0375% and 15% of the available P element in NPK inorganic fertilizers comes from a combination of phosphate rock with sulfuric acid which fixes P, so that P available in the soil, a symbiosis occurs between NPK fertilizer and Carbontiliser fertilizer where these two fertilizers contribute nutrients to each other in the soil. According to (Chuaca et al., 2019) states that the availability of P in the soil is also caused by an increase in soil Ph so that plants can absorb adequate amounts, besides that the difference in root weight is quite relevant so that it affects the absorption of P by plants.

The highest soil Potassium content, namely 66.45%, was produced from a combination of 30 g NPK and 75 g Carbontiliser treatment. This is caused by the application of NPK and Carbontiliser fertilizers to beach sand soil which can cause an increase in K ions absorbed by colloidal clay or humus of 1.02 cmol (+) kg-1 (through the decomposition of organic matter) therefore potassium is available in the soil. Because it is not easily leached. According to (Kaya, 2014) NPK fertilizer applied to soil can increase soil K availability due to the nature of NPK fertilizer which dissolves easily in water, which results in 15% K2O in the dissolved fertilizer in the soil and produces K cations in soil solution.

The best C-Organic content was 1.38% resulting from a combination of 0 g NPK and 100 g Carbontiliser treatment. This is because alternative raw materials with high C content are lignite coal, coal-based carbontiliser fertilizers contain 69% C, 5.5% H, 25% O, 0.5% N, 0.04% P2O and 0 K2O. 36%. This is in line with research (Shaheen & Matien, 2016) which states that there is a straight line between the increase in soil organic matter components and total soil nitrogen.

Table 7. Effect of NPK fertilizer on the growth of oil palm seedlings in the Pre Nursery.

Parameter	NPK			
	0 g	15 g	30 g	45 g
Plant Height	34.50 a	34.79 a	32.91 a	32.71 a
Leaf Area	198.57 a	200.34 a	199.35 a	191.57 a

Stem Diameter	10.96 a	11.02 a	10.47 a	10.41 a
Plant Fresh Weight	12.37 a	12.53 a	12.11 a	11.69 a
Plant Dry Weight	2.66 a	2.72 a	2.68 a	2.46 a
Root Volume	0.45 a	0.43 a	0.36 a	0.38 a
Root Fresh Weight	3.49 a	2.98 a	3.22 a	2.90 a
Root Dry Weight	0.62 a	0.57 a	0.58 a	0.54 a
Nitrogen Uptake	0.10	0.10	0.11	0.05

Information: The mean number followed by the same letter is not significantly different based on the DMRT test at the 5% level of significance.
(-) : No real interaction.

The results of variance showed that the application of NPK fertilizer had no significant effect on the parameters of plant height, leaf area, stem diameter, plant fresh weight, plant dry weight, root volume, root fresh weight, root dry weight and nitrogen uptake.

Table 8. Effect of Carbontiliser Fertilizer on the growth of oil palm seedlings in the Pre Nursery.

Parameter	Carbontiliser			
	0 g	50 g	75 g	100 g
Plant Height	33.63 p	35.38 p	31.91 p	34.00 p
Leaf Area	206.37 p	205.41 p	184.71 p	193.34 p
Stem Diameter	11.13 p	10.99 p	10.55 p	10.19 p
Plant Fresh Weight	12.82 p	12.98 p	11.18 p	11.72 p
Plant Dry Weight	2.81 p	2.79 p	2.45 p	2.47 p
Root Volume	0.42 p	0.40 p	0.45 p	0.35 p
Root Fresh Weight	3.17 p	3.30 p	3.14 p	2.99 p
Root Dry Weight	0.58 p	0.60 p	0.58 p	0.53 p
Nitrogen Uptake	0.06	0.11	0.09	0.10

Information: The mean number followed by the same letter is not significantly different based on the DMRT test at the 5% level of significance.
(-) : No real interaction.

The results of variance showed that the application of carbontiliser fertilizer had no significant effect on the parameters of plant height, leaf area, stem diameter, plant fresh weight, plant dry weight, root volume, root fresh weight, root dry weight and nitrogen uptake.

V. CONCLUSION

There is a significant effect and interaction between the doses of carbontiliser fertilizer and the dose of NPK fertilizer on the number of leaves, pH, soil N, soil P, soil K and C - soil organic. The application of NPK and Carbontiliser fertilizers has a good effect on soil N because the two fertilizers are in symbiosis to meet each other's nutrient needs in the soil. The application of carbontiliser and NPK fertilizers had no significant effect and there was no interaction on the parameters of plant height, leaf area, stem diameter, plant fresh weight, plant dry weight, root volume, root fresh weight and root dry weight.

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