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Effect of Organic Fertilizers and Inorganic Fertilizers on the Growth of Maize Plant (*Zea mays* L.)

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***Abstract*—** *This study aims to determine the effect of organic fertilizers (from goat feces and paitan leaves) and inorganic fertilizers (Urea, SP-36 and KCL) on the growth of maize (Zea mays L.). This study used a completely randomized design experimental design method (CRD) with 3 treatments, namely P1 (without treatment), P2 (application of inorganic fertilizers (Urea 3,6g, SP-36 3,8g and KCL 3,8g)) and (fertilizer application). Organic as much as 68g and each treatment was repeated for 5 replications. The variables observed in this study included plant height, number of leaves, leaf length, leaf width and dry matter of maize (Zea mays L.). The results showed that during 6 weeks of observation on the growth of maize (Zea mays L.), the best treatment is P3 (application of organic fertilizer as much as 68g). Namely with an average plant height of 131.35 cm, an average number of leaves 9.80, a plant length of 97.03 cm and an average leaf width of 6.46 cm*.

I. INTRODUCTION

Corn is a type of food plant in the form of grains or cereal types that exist in Indonesia, especially in lowland areas. Corn plants have good adaptability, so that they are widely distributed in areas in Indonesia [1]. Corn (*Zea mays* L.) has a large share in the growth of the upstream to downstream industries and is a significant contributor to the national economy. Corn (*Zea mays* L.) is an economically valuable commodity and is the main source of carbohydrates and protein. Corn is used as a source of raw material for animal feed and has the largest share compared to other types of raw materials [2].

Plants need nutrients to support their growth. One of the functions of nutrients is to store carbon stocks in the soil. Nutrients needed by plants include C, N, P, K, Ca, Mg, Na, Fe, Mn, Cu and many other nutrients [3]. So it is necessary to fertilize so that the elements of the haranya can be fulfilled.

Fertilization is an effort to increase soil fertility, so that the results obtained can be optimal [4] The application of organic fertilizers can improve soil structure, increase water absorption in the soil, increase microorganisms in the soil, and a source of nutrients for plants. Meanwhile, the application of inorganic fertilizers can stimulate plant growth such as the addition of branches, height of stems, number of leaves and has an important role in the formation of green leaves. This study aims to determine the effect of giving organic fertilizers (from goat feces and paitan leaves) and inorganic fertilizers (Urea, SP-36 and KCL) on the growth of maize (*Zea mays* L.).

II. MATERIALS AND METHODS

A. Materials

This research was conducted from February 2021 to March 2021. This research was conducted at the Wengker Park of the Environmental Service, Ponorogo, East Java. The materials used in this study were NK 212 corn seeds, organic fertilizer as much as 340g (organic fertilizer in this study is the result of composting of 600g of goat feces, 400g of paitan leaves, 3 ml of EM4 and molasses each and as much as water. 50 ml) and inorganic fertilizers (Urea = 18g, SP-36 = 19g and KCL = 19g). While the tools used include taper, polybag 40x40, sprayer, measuring cup, thermometer, digital analytical scale, ruler, writing instruments and documentation tools.

B. Experimental Design

This study used a completely randomized design experimental design method (CRD) with 3 treatments and each treatment was repeated 5 replications. The treatment with 5 replications was used as follows:
P1: Without Fertilizer Treatment
P2: Provision of Commercial Fertilizer (Urea = 3.6g, SP-36 = 3.8g and KCL = 3.8g)
P3: Organic Fertilizer from goat feces and paitan 68g

C. Variables Observed

Observation of the growth of maize (*Zea mays* L.) is observed once a week for 6 weeks, which includes:
a) Plant Height (cm)
b) Number of leaves (strands)
c) Leaf Length (cm)
d) Leaf Width (cm)
D. Statistical Analysis

All data on this research analyzed with one way analysis of variance (ANOVA) and continued with Duncan's Multiple Range Test (DMRT) if there were significant differences.

III. RESULTS AND DISCUSSION

A. Plant Height

Plant height is one of the reference parameters for observations from the results of the treatment given to plants, which is an easy-to-see growth indicator [5]. Based on the results of observations and analysis of variance shows that the treatment of P1 (without applying fertilizer), P2 (providing inorganic fertilizer Urea 3,6g, SP-36 3,8g and KCL 3,8g) and P3 (giving organic fertilizer from goat feces and paitan leaves

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68g) were not significantly different at 1 WAP observation. For 2 WAP, 3 WAP, 4 WAP, 5 WAP observations showed very significant differences and observations at 6 WAP showed significant differences. The average maize plant height can be seen in Table 1.

TABLE 1. Average height of maize plants for 6 weeks

Treatment	Tinggi Tanaman (cm)					
	1WAP	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
P1	9.33	26.32^{a}	59.15^{a}	72.47^{a}	110.04^{a}	128.32^{a}
P2	9.80	27.43^{b}	62.38^{b}	73.03^{b}	119.32^{b}	130.19^{ab}
P3	10.23	28.38^{c}	63.89^{c}	74.08^{c}	120.32^{b}	131.35^{b}
Duncan 5%	NS	**	**	**	**	*

Note : Numbers followed by different letters in the same column indicate a significant difference in the 5% Duncan test. NS = Not significantly different in the 5% Duncan test; * = Significantly different in the 5% Duncan test; ** = Very significant difference in Duncan's test at 1% .; WAP = Weeks After Planting

Based on Table 1, the average height of maize plants each week has increased in all treatments. For treatment P3 (giving organic fertilizer from goat feces and paitan leaves) had a higher plant height compared to treatment P1 (without applying fertilizer) and P2 (giving inorganic fertilizers to Urea, SP-36 and KCL) with a significant difference. It is suspected that P3 treatment (organic fertilizer from goat feces and paitan leaves) contains ideal nutrients and can be absorbed optimally by maize plants. So that this organic fertilizer can affect the height of the maize plant. [6] Organic fertilizer from goat manure contains nutrients needed by plants. [7] Organic fertilizer from goat manure contains macro elements such as nitrogen as much as 2.43%, potassium 0.73% and calcium 1.95%.

B. Number of Leaves

Observation of the number of leaves aims to determine the growth of maize plants in the photosynthesis process. [8] The photosynthesis process will run more optimally if the development of the number of leaves increases. This is because the more leaves, the more light will be caught. Based on data from observations, it shows that the treatment of P1 (without applying fertilizer), P2 (providing inorganic fertilizer Urea 3,6g, SP-36 3,8g and KCL 3,8g) and P3 (giving organic fertilizers from goat feces and paitan leaves (68g) were significantly different at 1 WAP and 6 WAP observations. For the observation of 2 WAP, 3 WAP, 4 WAP, 5 WAP shows very significant differences. The average number of leaves of maize for 6 weeks can be seen in Table 2.

TABLE 2. Average number of leaves of maize for 6 weeks

Treatment	Jumlah Daun (helai)					
	1 WAP	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
P1	2.36^{a}	4.88^{a}	6.24^{a}	7.00^{a}	8.12^{a}	9.44^{a}
P2	2.38^{a}	5.48^{b}	7.12^{ab}	8.56^{b}	9.20^{b}	9.68^{ab}
P3	2.80^{b}	6.36^{c}	7.52^{b}	8.20^{b}	8.92^{b}	9.80^{b}
Duncan 5%	*	**	**	**	**	*

Note : Numbers followed by different letters in the same column indicate a significant difference in the 5% Duncan test. * = Significantly different in the 5% Duncan test; ** = Very significant difference in Duncan's test at 1% .; WAP = Weeks After Planting

Based on the data in Table 2. on the parameter of the number of leaves, it can be seen that the maize plant has increased per week for 6 weeks of observation in all treatments. At the end of the observation, at 6 WAP, the P3 treatment (organic fertilizer from goat feces and 68g paitan leaves) had the highest average number of leaves compared to other treatments, namely 9.80 strands. [9] The number of leaves generally ranges from 10-18 pieces. The average appearance of perfectly open leaves is 3-4 days per leaf. The maize plant in the tropics has a relatively higher number of leaves than in temperate climates.

C. Leaf Length

Based on the results of observations and analysis of the variety of leaf lengths in maize, it was shown that the treatment of P1 (without applying fertilizer), P2 (providing inorganic Urea 3,6g, SP-36 3,8g and KCL 3,8g) and P3 (The application of organic fertilizer from goat feces and paitan leaves as much as 68g) was significantly different at 1 WAP observation. For the observation of 2 WAP, 3 WAP and 6 WAP showed very significant differences and observations at 4 WAP and 5 WAP showed no significant difference in leaf length of maize plants. The average leaf length of maize for 6 weeks can be seen in Table 3.

TABLE 3. Average leaf length of maize for 6 weeks

Treatment	Panjang Daun (cm)					
	1 WAP	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
P1	4.62^{a}	13.63^{a}	30.81^{a}	44.20	69.91	94.45^{a}
P2	4.77^{ab}	14.80^{b}	33.84^{ab}	44.64	69.98	96.58^{b}
P3	4.83^{b}	14.96^{b}	34.52^{b}	44.58	70.00	97.03^{b}
Duncan 5%	*	**	**	NS	NS	**

Note : Numbers followed by different letters in the same column indicate a significant difference in the 5% Duncan test. NS = Not significantly different in the 5% Duncan test; * = Significantly different in the 5% Duncan test; ** = Very significant difference in Duncan's test at 1% .; WAP = Weeks After Planting

Based on the average leaf length of the maize plant for 6 weeks, it was shown that the longest leaves were found in the P3 treatment (application of 68g of organic fertilizer from goat feces and paitan leaves), showing the highest yields from the beginning of the analysis (1 WAP) to the final analysis (6 WAP) reaches 97.03 cm. [10] Giving solid organic fertilizers can increase the average length of leaves on plants. Organic fertilizers contain nutrients, especially nitrogen and phosphorus, which affect the length of the leaves. Nitrogen has the largest contribution in plant growth. Because the function of nitrogen is as a source of protein, nucleic acids, hormones, chlorophyll, coenzymes and organic molecules that are important for plants in the process of cell growth and differentiation. [11] Added that nitrogen is needed by plants during their vegetative growth period, such as the effect on the formation of wider and longer leaves.

D. Leaf Width

Based on the results of observations of leaf width on maize (Zea mays L.) for 6 weeks. The results of the calculation of the average leaf width of maize for 6 weeks can be seen in Table 4.

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TABLE 4. Average leaf width of maize for 6 weeks

Treatment	Lebar Daun (cm)					
	1 WAP	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
P1	1.34[a]	1.57[a]	2.12[a]	4.06[a]	4.75	6.66[a]
P2	1.44[b]	1.70[b]	2.20[ab]	4.51[b]	4.64	6.36[b]
P3	1.46[b]	1.78[b]	2.30[b]	4.72[c]	4.75	6.68[b]
Duncan 5%	**	**	**	**	NS	*

Note : Numbers followed by different letters in the same column indicate a significant difference in the 5% Duncan test. NS = Not significantly different in the 5% Duncan test; * = Significantly different in the 5% Duncan test; ** = Very significant difference in Duncan's test at 1% .; WAP = Weeks After Planting

Based on the results of observations and analysis of the variety of leaf width in maize plants showed that the treatment of P1 (without applying fertilizer), P2 (giving inorganic fertilizer Urea 3,6g, SP-36 3,8g and KCL 3,8g) and P3 (giving organic fertilizer from goat feces and paitan leaves as much as 68g) were very significantly different at 1 WAP, 2 WAP, 3 WAP and 4 WAP observations. Meanwhile, at 5 WAP there was no significant difference in leaf width of maize plants. And 6 WAP showed a significant difference in leaf width of maize plants. It is suspected that the application of organic fertilizers from goat feces and paitan leaves has an effect on leaf width in corn plants because they contain nutrients in organic fertilizers that can be absorbed properly. [12] Giving organic fertilizers can increase leaf width in plants. In organic fertilizers, there are nutrients that can increase leaf width growth, especially nitrogen. Besides that, in organic fertilizers there are also other nutrients, such as magnesium (Mg) which has a role in helping phosphorus to activate the phosphorylation process. So that the performance of phosphorus will increase in energy transfer ATP (adenine triphospate). [13] nitrogen content has an important role, namely as a constituent of essential compounds for plants. In the process of photosynthesis, nitrogen can stimulate the formation of green leaves, so that the leaves can develop optimally.

IV. CONCLUSION

Based on the results of the study, it can be concluded that organic fertilizers from goat feces and paitan leaves gave the best treatment compared to the use of inorganic fertilizers. Namely, with an average plant height of 131.35 cm, an average number of leaves 9.80, a plant length of 97.03 cm and an average leaf width of 6.46 cm.

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