Utilization of Organic Waste on the Growth and Production of Sweet Corn (*Zea mays* Saccharata. L)

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Posted Date: 8 October 2023

doi: 10.20944/preprints202310.0422.v1

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Article

Utilization of Organic Waste on the Growth and Production of Sweet Corn (Zea Mays saccharata. L)

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Abstract: Organic fertilizers are fertilizers made from organic materials which are partly or wholly derived from waste materials, the function of these fertilizers is to improve the physical, biological, and chemical properties of the soil, these fertilizers are processed through the composting process, these fertilizers are very much needed because they are difficult to obtain at a high price. expensive. This study aims to obtain data on the growth and yield of sweet corn, due to the use of agricultural waste as organic fertilizer. The research method was experimentally consisting of 5 treatments and 5 replications; ie P0 = Without organic fertilizer (control) P1 = Dosage of organic fertilizer 2.5 tons/ha, P2 = Dosage of organic fertilizer 5 tons/ha P3 = Dosage of organic fertilizer 7.5 tons/ha, P4 = Dosage of organic fertilizer 10 tons /ha using a Randomized Block Design (RBD) The results showed that organic fertilizer had a significant effect on plant height aged 30, 40 and 50 DAP, had a very significant effect on cob length at a dose of 10 t.ha-1 and, had no significant effect on cob weight, will still have a high weight of 350 g.cob-1 From this description it can be concluded that organic compost can be used as a substitute for chemical fertilizers which provides an increase in the growth and production of sweet corn plants at the use of 10 tons/ha.

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Introduction

Fertilizer is one of the limiting factors in agricultural cultivation, without fertilizer the plants will languish in their growth because nutritional needs are not met. In general, soils in the wet tropics are deficient in nutrients, especially N, P, and K in corn plants, so to get results close to yielding potential, additional fertilizer is needed, the amount of which really depends on the environment and plant management (Tabri, 2010). Lately, it needs fertilizer is increasingly difficult to obtain, although it is urgently needed, especially chemical fertilizers according to a report from the Ministry of Agriculture (2021) that the fertilizer allocation reaches 9 million tons plus 1.5 million liters of liquid organic fertilizer, even though in 2020 the allocation was only 8.9 million tons. This increase in demand was due to the increasing area of agricultural land, which increased from 24.1 million hectares to 25.1 million hectares (Gunawan 2021). , 2012) that the increase in the amount of fertilizer is based on several things, including because so far farmers have used low doses of fertilizer after carrying out according to the recommended dosage, there has been an increase in the number of requests. In addition, there were also price increases, both subsidized and non-subsidized prices. According to (Ragimun et al 2020) that this is caused by the long distribution chain of subsidized fertilizers. The helplessness of farmers to the need for fertilizer is a problem and it is our responsibility to find a way out.

One solution that can be done is the use of organic fertilizers derived from agricultural waste. Agricultural waste that is used as fertilizer is banana weevil, rice husk biochar, and chicken manure. Banana weevil according to (Tuhuteru et al., 2019) contains many microorganisms including Bacillus sp., Aeromonas sp., and Aspergillus nigger. These microbes function as organic matter, and act as decomposers to be composted, the decomposition process is broken down into elements that plants can use to grow and develop (Hort et al., 2015)

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Furthermore, rice husk biochar functions as a very good soil conditioner because it contains a high C/N ratio, besides that rice husk has a lot of it. found that the proportion of rice husk was 16-28% of the total dry-milled grain; (Neneng et al., 2015). Meanwhile, chicken manure contains essential nutrients for plants, both macro and micronutrients, including N. The high N content in chicken manure is absorbed more quickly by plants than goat manure and cow manure (Nurjanah et al., 2020). (Lukman, 2022) stated that the compost content of the chicken coop added with banana weevils and biochar contained 2.01% N, 43.23 C-Organic, 21.51 C/N Ratio, and 7.6 pH.The addition of organic matter to the soil will provide benefits for improving soil properties, especially for increasing nutrients in the soil and containing most of the elements needed by plants in a relatively balanced ratio, even though the levels are very small (Roidah, 2013). Dahunsi et al., (2021) stated that the use of organic fertilizers is one way to overcome dependence on inorganic fertilizers, organic matter functions as a binder of primary soil granules into secondary granules in the formation of solid aggregates (Hidayah et al., 2016).Soetrisno and Yoku, (2019) explain that the results of the application of organic fertilizers combined with N, P, and K fertilizers have an effect on C-organic, C/N, and N uptake with an organic matter content of 2-10% can improve physical function, soil chemistry, and biology (Kalay et al., 2020). Corn plants require sufficient nutrients for growth and production, the organic fertilizer used in this study is organic fertilizer that has been through a process composting with a nutrient content of 0.27% N, 3.20% P, 1.63% K, and 17.40% C-Organic (Lukman, 2021).The purpose of this study was to obtain the right dose of organic fertilizer application from agricultural waste on the growth and yield of sweet corn.

Research Methods

This research is a quantitative experimental research using a one-factor Randomized Block Design (RBD), namely on organic fertilizers with 5 treatment levels, namely:

P0 = without organic fertilizer (control)
P1 = 2.5 ton.ha-1 dose equivalent to 8.3 g.plant-1
P2 = 5 tons.ha-1 dose equivalent to 16.6 g.plant-1
P3 = 7.5 ton.ha-1 dose equivalent to 25 g.plant-1
p4 = 10 ton.ha-1 dose equivalent to 33.3 g.plant-1
Making organic fertilizer:
Tool

The tools used are Hoes, machetes, shovels, knives, tape measure, digital cameras, and stationery.

Material

The materials used in this research were: Bonanza F1 sweet corn seeds and organic fertilizer. raffia rope, regen type insecticide, gramoxone type herbicide, treatment label.

Fertilizer material

a) Chicken manure 50 kg
b) 30 kg banana weevil
c) Dry Cocoa Skin 10 Kg
d) Biochar 10 kg
e) EM4 100 ml

first weevil is cut into small pieces with a size of 5-10 cm. then mixed with chicken manure, biochar, and EM4, then covered for 10 days, finely ground, and then closed again for 7 days, air dried until the water content is low, to get a fine texture, then sifted with a size of 4.8 ml**.** In this study, 180 plants were used, which were in 3 replicates with 5 treatments so there were 15 treatment plots, each plot contained 12 plants, but 3 plants were used as samples from each plot so that the total sample was 45 plants. Observational variables consist of:

a) Plant height was measured from the ground surface to the point of growth or the tip of the highest leaf. Measurements were made at the age of 20 days after planting (DAP), 30 DAP, 40 DAP, and 50 DAP.

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b) The number of leaves, counted all the leaves contained in the corn plant starting at the age of 20 days after planting (DAP), 30 DAP, 40 DAP, and 50 DAP.mur 20 Hari setelah tanam (HST), 30 HST, 40 HST dan 50 HST.

c) The average cob length (cm) was measured at 75 DAP using a ruler

d) The average cob weight (kg), as well as the cob weight (plant samples), were weighed using a digital scale

Observational data were then analyzed using a one-factor Randomized Block Design (RBD).

Results and Discussion

Plant height

The application of organic fertilizer with doses (P2 = 5 t.ha-1) had an effect on the average plant height (110.33cm) which was not significantly different from the doses of organic fertilizers P3 and P4, but significantly different from the control treatment. Similarly, in the observation of plant height at 40 HST, it gave an average effect (190.78cm) in the treatment with doses (P3 = 7.5 5 t.ha-1) which were not significantly different from the doses of organic fertilizers P2 and P4, but significantly different from the control treatment. Meanwhile, at the age of 50 HST, the dose of organic fertilizer (P2 = 5 t.ha-1) resulted in taller plants (257.53 cm) not different from the dose of organic fertilizer P3 and P4 but different from the control treatment.

The average height of corn plants at various doses of organic fertilizer treatment is presented in the following figure.

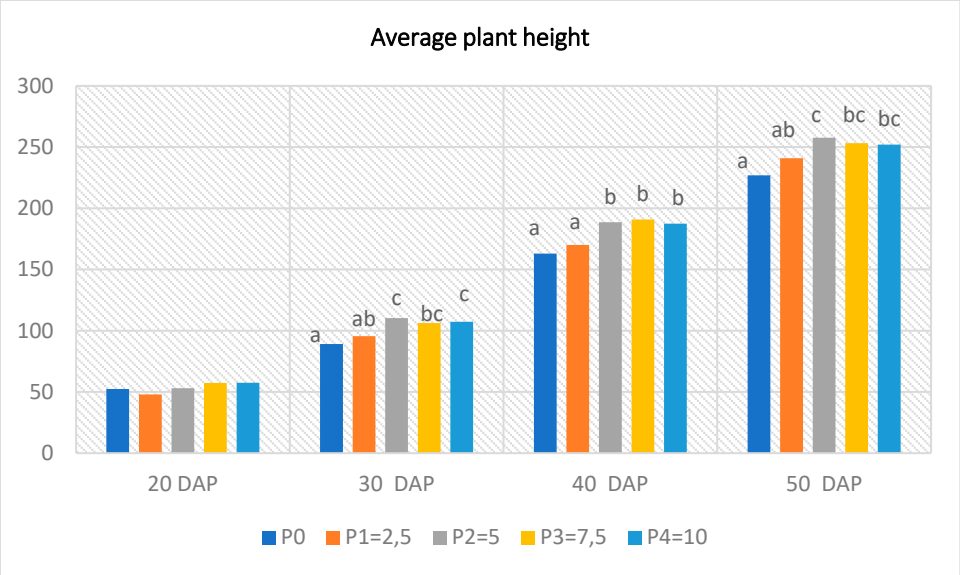

Figure 1. The average height of corn plants (cm) at various doses of organic fertilizer treatment at the age of 20, 30, 40 and 50 DAP.

Application of organic fertilizer with a dose of P2 = 5 t.ha-1 with P3 = 7.5 5 t.ha-1 produced higher plants. This is possible because at the age of 20 HST, the need for nutrients for corn plants is relatively small so there is no competition in utilizing existing nutrients, causing the organic fertilizers given to have no real effect. However, as the plant ages, the need for nutrients will increase, (Lin et al., 2019) stated that corn plants require high N during the early growth period. This can be seen in the response of corn plants to organic fertilizers. Addition of fertilizer Organic fertilizers can increase the growth and development of sweet corn plants, besides that organic fertilizers can increase the soil's ability to store water. With the availability of water, it can help the process of weathering mineral and soil organic matter so that it can be used directly by plants. In addition, water also functions as a medium root movement to absorb nutrients in the soil, and distribute them to all parts of the plant organs. One of the things that makes plants taller is due to the availability of N elements in the soil through

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the fertilizers given (J. Liu et al., 2021), N fertilizers that are High levels generally increase protein, secondary structure formation, and lipid accumulation. (Wijanarko et al., 2012) states that the addition of organic matter in the soil in the form of manure or crop waste can increase the N content. The nutrient N plays an important role in the growth and generative phases of plants. (Crous et al., 2019) states that the nitrogen contained in organic fertilizers can be available to plants, although slowly.

In addition to the N element also present in the experimental fertilizer, there are also P and K elements, so it can be said that the height of the corn plant can also be affected by the P nutrient available in the fertilizer given. Increasing the dose of P fertilizer causes an increase in the available P concentration in the soil so that it becomes easier for plants to absorb P in the soil to support their growth. Phosphorus (P) is an essential macronutrient for normal plant growth. It is not only a key component of macromolecules, such as proteins, nucleic acids, plasma membranes, ATP, vitamins, and some secondary compounds but also plays an important role in the metabolism of nitrogen compounds, carbohydrate transport, carbohydrate metabolism, and fat metabolism (Meng et al., 2021) Deficiency of element P will cause stunted plant growth (dwarf).

Number of Leaves

The results of variance showed that the treatment of various doses of organic fertilizer had no significant effect on the number of leaves of corn plants at 20, 30, and 50 HST, but had a significant effect at 40 HST. Shows that for the 40 HST observation, the application of organic fertilizer at a dose of P1 = 2.5 t.ha-1 produced the highest number of leaves not significantly different from the P2 and P3 treatments, but significantly different from the P0 and P4 treatments. While the lowest number of leaves was found in treatment P0 (control).

The average number of leaves of corn plants at various doses of organic fertilizer treatment is presented in the following figure:

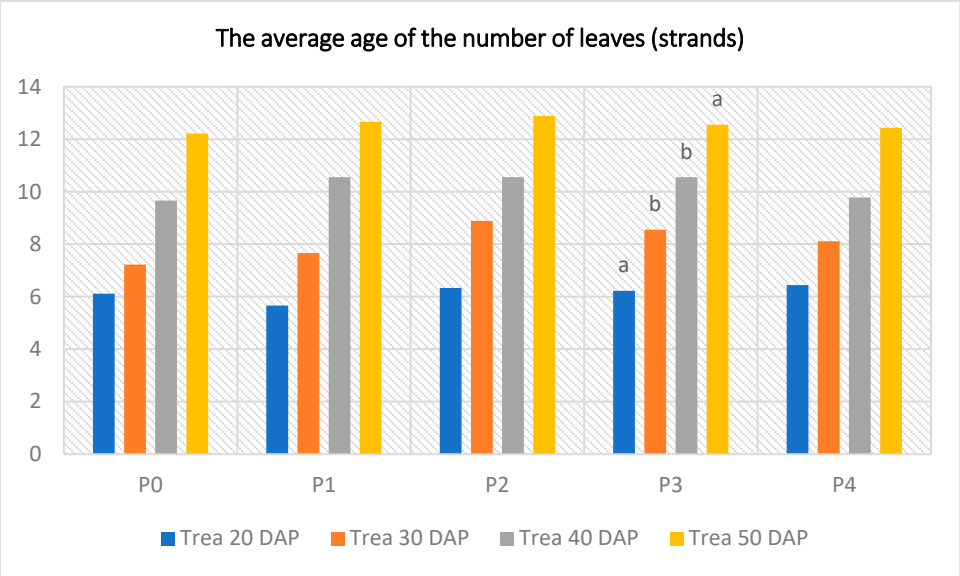

Figure 2. The average number of corn plant leaves (strands) at various doses of organic fertilizer treatment at the age of 20, 30, 40 and 50 DAP.

This is due to the fact that at the age of 20 and 30 HST, the need for nutrients for corn plants is relatively small so there is no competition in utilizing existing nutrients, causing the organic fertilizers given to have no real effect on the number of leaves, even though corn plants are plants that are can use the potential of the environment well. Corn belongs In C4 plants, photosynthetic activity in normal conditions is relatively high, photorespiration is very low, and transpiration is low and efficient in water use. These properties are physiological and anatomical properties that are very

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beneficial in terms of yield (Muhadjir, 2018). According to (X. Liu et al., 2011) organic fertilizers increase root activity within 40 days after planting and during this period organic fertilizers increase root activity, increase photosynthesis, and subsequent growth rates. However, as the plant gets older, the need for nutrients will increase, this can be seen in the response of corn plants to organic fertilizers, where the dose of fertilizer P1 = 2.5 t.ha-1, shows a better effect on the number of leaves compared to the control treatment. It is suspected that the increase in the number of leaves occurs because it is influenced by the availability of nutrients such as nitrogen contained in organic fertilizers. Nitrogen has an important role in stimulating overall plant growth, especially stems, branches, and leaves. In addition, nitrogen also plays an important role in the formation of leaf-green substances which are very useful in the process of photosynthesis (Yulina & Ambarsari, 2021; Kalay et al., 2020). et al., 2019).Nitrogen is needed to produce proteins, fats, and various other organic compounds. Nitrogen is important in terms of the formation of green leaves which are very useful in the process of photosynthesis. Organic materials provide almost all the elements needed by plants in a relatively balanced ratio, even though the levels are very small. So that long-term soil management or sustainability of farming, it is very good to pay attention to and maintain soil organic matter levels.Gardner et al. (1991), stated that with the amount of sunlight received by plants, they will respond by increasing the number of leaf blades. With an increase in the number of leaf blades, the more carbohydrates produced by these plants in the process of photosynthesis so that it will accelerate plant growth and development.

Average Cob Length (cm)

The results of variance showed that the treatment of various doses of organic fertilizer had a very significant effect on the average length of corn cobs. The length of the cob at the dose of P4 = 10 t.ha-1 indicates that the plant's need for the necessary nutrients has been fulfilled.

The average length of corn cobs at various doses of organic fertilizer is presented in the following figure.

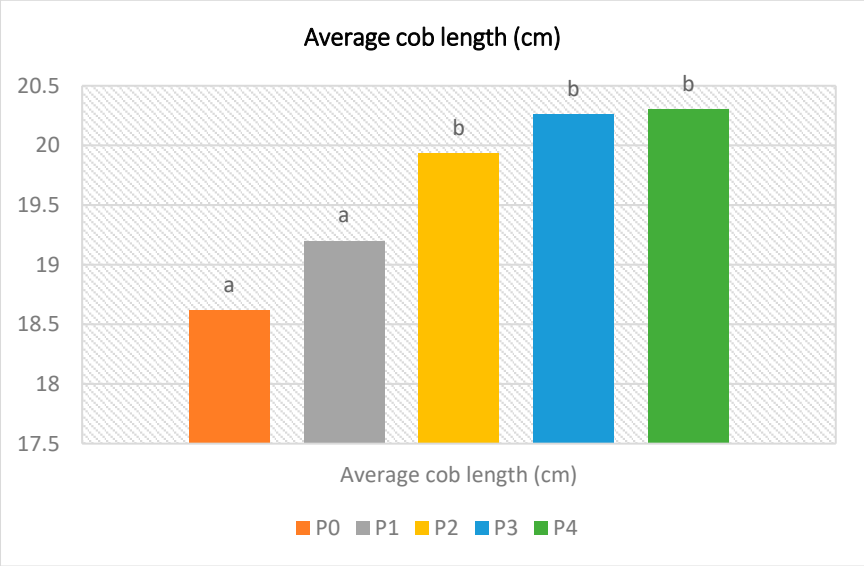

Figure 3. Average corn cob length (cm) at various doses of organic fertilizer treatment.

The length of cobs and cobs is strongly influenced by the completeness of the elements N, P and K. Pasta et al., (2015) stated that the application of NPK fertilizer at a dose of 350 kg.ha-1 had a significant effect on the cob length of sweet corn reaching up to 21.8 cm, this figure not much different from the use of organic fertilizer treatment of 10 ton.ha-1 which is 20.30 cm, thus that the use of organic fertilizer is 33.3 grams. Plant-1 can have the same effect as the use of 350 kg.ha-1 chemical fertilizer. Furthermore, according to (Ray et al., 2020) that the N element that can be absorbed by

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plants greatly affects the length of the cobs/plants produced. In addition, corn plants require phosphorus for the optimal development of cob diameter and length (Intan Yufantari, 2020; Hidayah et al., 2016).

Average Cob Weight (kg)

Based on the results of statistical tests showed that the average weight of sweet corn cob was not significantly different, but the average weight reached up to 350 g.cob-1. This shows that even though it was not significantly different from other treatments, the fertilizer treatment had an effect on the fruit or cob formation process.

The average weight of corn cobs at various doses of organic fertilizer is presented in the following figure.

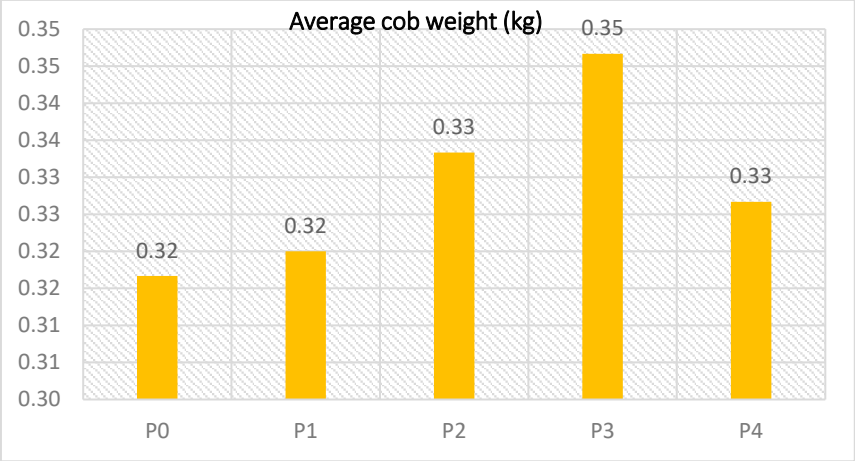

Figure 4. The average weight of corn cobs at various doses of organic fertilizer.

The weight of the cobs for planting reaches 304.75 g and weighs 13.00 tons. ha-1 when using complete fertilizers, namely a combination of organic and inorganic fertilizers (Hawalid, 2019; Labongkeng et al., 2021). Increasing the availability and absorption of N, P, and K nutrients in organic fertilizers can stimulate the vegetative and generative growth of plants in sweet corn plants, according to Syafruddin, (2015); (Sharma et al., 2019; Riadi et al., 2021) that the dose of fertilizer N for hybrid corn plants with a yield opportunity of 9–13 t/ha is 160–260 kg N/ha for soils with low C-organic content, whereas in the treatment fertilizer the use of 7.5 tons/ha equivalent to 25 g.plant-1 with C-organic 17.4% can increase the yield of 350 g.cob-1. In line with the results of the statement (Liu et al., 2021; Hafez, 2015) that the application of 200 kg ha-1 nitrogen can increase the number of seeds, cob diameter, volume, and dry weight of corn plant roots. The use of Nitrogen (N) on the quality and quantity of yield plants includes the process of filling the seeds completely so that they can harden and prevent wasting of the seeds at the ends of the cobs, this is positively correlated with the weight of the cobs in corn plants (Ray et al., 2020); Haffez et al., 2019) further added (Soleymani, A. 2018 Iqbal et al., 2021; Hua et al., 2020) that. the use of N can increase crop yield and growth of corn plants.In addition to the N element, the K element also greatly influences the production of sweet corn, namely on cob weight, the K element functions in plant physiological processes. So that it will affect the development of corn plant cells, element K is an enzyme activator that is very important in the photosynthate accumulation rate process, and if it is not running optimally it will result in lower plant biomass.

(A. Mam Rasul, 2010) states that KCl fertilization causes an increase in dry matter yield of 71.17%Adding organic matter to the soil can increase the availability of P, besides that phosphorus functions to balance soil fertility (Ortas & Islam, 2018). Moreover, the organic fertilizer used in this study contains 3.2% phosphorus with 17.4% C-organic (Lukman, 2019) High organic C will make it easier for roots to absorb available nutrients, and facilitate the process of mineralization, mineralization of organic matter can release P elements which are bound by Al and Fe so that they

can be used by plants. According to (Ortas & Islam, 2018) most soils contain large amounts of total P, but the available P content for plants is generally low due to high rainfall, while the formation of cobs and seeds is strongly influenced by the availability of P nutrients in the soil so that it is necessary to do the addition so that these nutrients remain available to plants.

Conclusion

The use of organic fertilizer from agricultural waste that has been processed by the composting method can increase the nutrient content so that it can increase the growth and yield of sweet corn plants optimally, according to the specified dosage.

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