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The Effect of Chicken Manure and SNN (Super Natural Nutrition) Liquid Organic Fertilizer Application on Sweet Corn Growth and Production (Zea mays L. saccaharata Sturt)

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ABSTRACT: This study aims to determine the effect of applying chicken manure and liquid organic fertilizer.SNN(super natural nutrition) on the growth and production of corn plants (Zea mays saccharata Sturt). This study used a Factorial Randomized Block Design (RAK) with two factors. The first factor is Liquid Organic FertilizerSNNconsists of 3 (three) levels: S0 = Control, S1 = 3 ml/l of water per plot, and S2 = 5 ml/l of water per plot. The second factor is chicken manure consisting of 4 (four) levels: A1 = 1 kg/plot (7 tons/ha), A2 = 1.5 kg/plot (10 tons/ha), A3 = 2 kg/plot (13 tons/ha) and A4 = 2.5 kg/plot (16.5 tons/ha). The study's results showed that the treatment of liquid organic fertilizers 5 ml/l of water per plot significantly affected plant height, stem diameter, and weight of cob with husk per plant. Chicken manure 2.5 kg/plot had no significant effect on plant height, stem diameter, or weight of cobs with husks per plant. Interaction between liquid organic fertilizer and chicken manure sometimes had no significant effect on all observed parameters.

Keywords: Chicken Manure, Liquid Organic Fertilizer, Sweet Corn

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INTRODUCTION

Sweet corn is a popular horticultural plant in the neighborhood due to its sweet flavor (Zea mays saccharata Sturt.). Moreover, sweet corn significantly contributes to fulfilling the population's nutritional requirements (Novira et al., 2015). Besides seeds, additional components like young stems and leaves may serve as animal feed, while aged stems and leaves (post-harvest) may be used for green manure or compost. Additionally, dried stems and leaves can function as fuel to substitute firewood, and young corn can be consumed as vegetables, among other uses (Syofia et al., 2014).

Sweet corn is a grain food crop from the grass family, and production in North Sumatra is decreasing from year to year, along with the increasing population. The highest corn production in North Sumatra is in Karo Regency, which is located in all sub-districts of Karo Regency. It has a land area of 92,000 hectares and a production of 551,863 tons. Corn plants in North Sumatra in 2017 produced 1,741,257 tons, with a sweet corn production of 45,272 tons; in 2018, it decreased to 1,710,784 tons, with a sweet corn production of 44,480 tons (Statistik, 2018).

One of the causes is the provision of fertilizer, and the amount of nutrients available in the soil has not met the needs of the plants (Selim, 2020). According to (Zubaidah, 2023), the nutrient content in the soil will decrease over time because it is often used by plants that live in it; if this condition is allowed to continue, the plants will lack nutrients, so growth and production will be disrupted. In addition, most of the corn planting land in Indonesia is dry land. The main problem with planting corn on dry land is that water needs depend entirely on rainfall and varying land fertility. In addition, other problems on dry land are soil pH and low organic matter content (Jia et al., 2020; Savitri & Rosa, 2019). Efforts to increase corn production can be made by adding organic materials. Organic materials have an important role in improving the physical properties of the soil. Good physical properties of the soil can guarantee the growth of plant roots through good aeration and drainage. The addition of sufficient organic materials can improve the soil structure to be looser so that the land area can produce optimal production (Asmawati et al., 2021; Ranesa & Tejowulan, 2024).

The continuous and excessive use of inorganic fertilizers may diminish soil fertility and harm environmental and soil health if not complemented with organic fertilizers. The efficiency and effectiveness of nutrient absorption by plants are not optimal, so the addition of organic fertilizers is needed (Hamid, 2019; Safitri, 2019).

This damage to the soil structure can occur due to incorrect soil processing or continuous use of chemical fertilizers. Biological damage is characterized by a decrease in population or a decrease in soil organisms and usually occurs not because of the damage itself but as a result of other damage (physical and/or chemical) (Goud et al., 2022; Tayoh, 2020; Yusuf et al., 2023).

Organic fertilizer consists of organic materials derived from plants and/or animals that have gone through an engineering process and can be in solid or liquid form, which significantly improves the soil's physical, chemical, and biological properties. The physical properties of the soil that organic materials can improve are soil permeability, soil porosity, and reducing water loss due to evaporation (Hamidah et al., 2023). The chemical properties of the soil that organic materials can improve prevent nutrient loss due to leaching, increase cation exchange capacity, increase soil pH, and bind cations so that they are readily available to plants. The biological properties of the soil that organic materials can improve include increasing the number of soil microbes, increasing the activity of soil microbes, and providing energy for soil microbes (Putra et al., 2024).

Incorrect Chicken dung is a sort of organic fertilizer that may be used. Chicken dung is a nutrient-rich fertilizer containing 2.6% nitrogen (N), 2.9% phosphorus (P), and 3.4% potassium (K), with a carbon-to-nitrogen (C/N) ratio of 8.3. This is because chickens are included in the poultry group, whose digestive system is relatively short, so few nutrients are absorbed. One of them is sweet corn plants because they can stimulate the growth of sweet corn plants and increase soil fertility, which will impact the plants' fertility. According to (Ritonga et al., 2022), chicken manure is waste excreted by chickens as a food process accompanied by urine and other food waste. (Aminah et al., 2022; Hutasoit et al., 2021) said that fertilizer is essential for soil fertility since it comprises one or more components that replenish those taken by plants.

Liquid organic fertilizer (POC) is an organic fertilizer in liquid form. It contains nutrients in the form of an excellent solution so plants can easily absorb it. Applied by watering or spraying on the leaves or stems of plants. SNN fertilizer is an organic fertilizer made with high technology, so it produces organic fertilizer but with a physical form and working method like chemical fertilizer (inorganic). This fertilizer can improve physical properties (soil structure, water retention capacity, and others). This fertilizer does not pollute the environment, so environmentalists highly recommend it.

THEORETICAL REVIEW

Chicken Manure

Animal excrement from agricultural practices includes chicken, cow, buffalo, and goat feces—the nutritional makeup of animal dung changes based on the quantity and kind of feed consumed. The nutritional composition of animal dung is often inferior to that of artificial fertilizers. Consequently, the expense of using this manure exceeds that of inorganic fertilizers. The nutrients in this manure are not readily accessible to plants. The accessibility of nutrients is significantly affected by the extent of breakdown and mineralization of these components (Siahaan, 2019).

The limited nutritional availability from manure results from nitrogen, phosphorus, and other elements in complex organoprotein complexes, humic acid compounds, or lignin, which are challenging to break down. Besides providing beneficial nutrients, manure also harbors weed seeds, saprophytic bacteria, pathogens, and parasite microbes that may pose risks to animals or people. For instance, chicken dung harbors Salmonella sp. Consequently, the management and application of manure must be conducted meticulously according to requirements (Sela, 2021).

Manure is defined as all waste products from domesticated animals that may be used to enhance soil nutrients and improve its physical and biological qualities. When rearing animals, if a substrate such as rice husks is provided for chickens and straw for cows, buffaloes, and horses, the substrate will be amalgamated into a single entity and referred to as manure. Chicken manure is the waste produced by chickens, consisting of excrement, urine, and residual food matter. Chicken dung serves as an organic fertilizer for several plant commodities. Sweet corn plants may enhance their development and improve soil fertility, positively affecting their overall fertility. Moreover, chicken dung may enhance the soil's physical, chemical, and biological characteristics (Rosita et al., 2020).

Broiler chicken dung has a comparatively elevated phosphorus nutritional concentration compared to other manure types. Numerous study findings indicate that applications of chicken manure provide optimal plant responses throughout the first season. This occurs because chicken dung decomposes more rapidly and has a higher nutritional content compared to equivalent quantities of other manures (Sinambela, 2022).

Chicken manure, as an organic material, contributes to developing a robust and stable soil structure, enhancing infiltration, water retention capacity, and permeability while simultaneously diminishing surface runoff, thereby improving the physical properties of the soil. Chicken dung may enhance the soil's chemical characteristics by elevating pH, calcium, organic carbon, total nitrogen, carbon-to-nitrogen ratio, and hydrogen deficiency levels while diminishing aluminum (Hs et al., 2022).

Liquid Organic Fertilizer SNN (Super Natural Nutrition)

Organic fertilizer consists of natural substances containing certain types and quantities of nutrients. Organic fertilizer is a crucial component in enhancing soil fertility. Using organic fertilizer does not result in residue on plant products, thereby ensuring safety for human health (Gultom et al., 2021). (Septirosya et al., 2019) defines liquid organic fertilizer as a nutrient source that aligns with the requirements of plants in the soil. Its liquid form allows plants to efficiently manage the absorption of necessary fertilizer components, even in excess fertilizer capacity in the soil. Liquid organic fertilizer (extract) offers uniform fertilization, preventing the accumulation of fertilizer concentration in specific areas. This fertilizer is entirely soluble and consistent, rapidly resolving nutrient deficiencies and prompt delivery. Plants mostly take nutrients via their roots. However, leaves may also absorb nutrients. Super Natural Nutrition organic fertilizer (SNN) is an effective liquid organic fertilizer that may reduce the reliance on inorganic fertilizers. Super Natural Nutrition Liquid Organic Fertilizer (SNN) applies to plantation crops, annuals, and perennial plants. Organic fertilizer (SNN) is derived from extracting organic materials sourced from livestock, plant, and natural waste, processed with an emphasis on environmentally sustainable technology. It contains essential macro and micronutrients required for plant growth, including N, P, K, Mg, S, Ca, Fe, Na, Zn, Cu, Mn, B, and Cl. The composition of SNN elements is derived via fermentation, enabling plants to absorb them rapidly due to their ionic nature. SNN components may elevate soil pH, diminish insect infestations, and eliminate inorganic fertilizer residues (Wilis & Puryani, 2024).

METHODOLOGY

This research will be conducted on Jalan Bunga Sedap Malam XVIII Medan Selayang, with an altitude of 32 m above sea level. This study aims to determine the effect of chicken manure and liquid organic fertilizer applications.SNN(super natural nutrition) on the growth and production of corn plants (Zea mays saccharata Sturt). This study used a Factorial Randomized Block Design (RAK) with two factors. The first factor is Liquid Organic FertilizerSNNconsists of 3 (three) levels: S0 = Control, S1 = 3 ml/l of water per plot, and S2 = 5 ml/l of water per plot. The second factor is chicken manure consisting of 4 (four) levels: A1 = 1 kg/plot (7 tons/ha), A2 = 1.5 kg/plot (10 tons/ha), A3 = 2 kg/plot (13 tons/ha) and A4 = 2.5 kg/plot (16.5 tons/ha). The parameters observed were plant height, stem diameter, and cob weight with husk per plant. Analysis of variance was used to test the effect of treatment and to test the difference in average between treatments; honest significant difference tests, regression, and correlation were carried out at the 5% test level.

RESULTS

Plant Height (cm)

Height measurements of sweet corn plants at 2, 3, 4, and 5 weeks post-planting (MST) in response to liquid organic fertilizer (SNN) and chicken manure. The variance analysis indicates that applying liquid organic fertilizer (SNN) significantly influenced plant height at 2 and 3 MST but not at 4 and 5 MST. Chicken manure treatment did not significantly influence the height of sweet corn plants at any observed age. The interaction between the two treatments did not significantly impact the height of sweet corn plants at any observed age. Table 1 displays the mean height of sweet corn plants at 2, 3, 4, and 5 MST as influenced by liquid organic fertilizer treatment (SNN) and various chicken manure applications.

Table 1. Average Plant Height (cm) of Sweet Corn Plants in Liquid Organic Fertilizer Treatment (SNN) and Chicken Manure 2, 3, 4 and 5 Weeks After Planting

Treatment	Plant Height (cm)			
	2 MST	3 MST	4 MST	5 MST
S0	40.69b	85.15a	128.19	164.05
S1	41.68ab	84.34a	129.97	164.90
S2	45.94a	90.97b	138.06	166.87
A1	45.31	88.08	136.74	167.79
A2	42.83	87.47	132.56	169.20
A3	41.13	86.84	128.21	158.79
A4	41.81	84.90	130.78	165.32

Information: Numbers followed by the same letter in the same column and group mean that they are not different based on Duncan's test at the 5% level.

Table 1 indicates that two weeks post-planting, the tallest plants in the liquid organic fertilizer treatment (sun) were seen in treatment s2, which was considerably different from s0 but not statistically different from s1. The height of plants under treatment in s1 did not change substantially from that in s0. Three weeks post-planting, the tallest specimens were seen in treatment s2, exhibiting a substantial difference from treatments s0 and s1. The height of plants under treatment in s1 did not change substantially from that in s0. Figure 1 illustrates liquid organic fertilizer's impact on sweet corn plants' height three weeks post-planting.

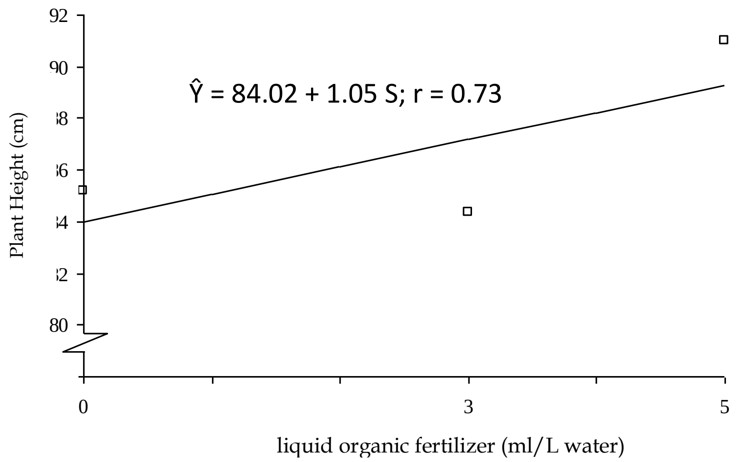

Figure 1. The effect of liquid organic fertilizer doses on the height of sweet corn plants at 3 weeks after planting

Figure 1 illustrates that an increased application of liquid organic fertilizer correlates with greater heights of sweet corn plants, as shown by a positive linear regression curve. Table 1 indicates that the application of chicken manure did not significantly influence the height of sweet corn plants. Treatment A2 exhibited the tallest sweet corn plants, whereas treatment A3 displayed the shortest.

Stem Diameter (mm)

Data on the number of leaves of sweet corn plants at 2, 3, 4, and 5 weeks after planting (MST) as influenced by liquid organic fertilizer (SNN) and chicken manure. The variance analysis indicates that the liquid organic fertilizer treatment (SNN) did not significantly influence stem diameter at ages 2, 3, and 4 MST but did have a significant impact at age 5 MST. Chicken manure treatment did not significantly impact the stem diameter of sweet corn plants at any observed age. The interaction between the two treatments did not significantly affect the stem diameter of sweet corn plants at any observed age. Table 3 displays the mean stem diameter of sweet corn at 2, 3, 4, and 5 MST as influenced by liquid organic fertilizer treatment (SNN) and various chicken manure applications.

Table 2. Average Stem Diameter (mm) of Sweet Corn Plants in Liquid Organic Fertilizer Treatment (SNN) and Chicken Manure 2, 3, 4 and 5 Weeks After Planting

Treatment	Bar Diameter (mm)			
	2 MST	3 MST	4 MST	5 MST
S0	0.59	1.14	1.99	2.09a
S1	0.60	1.03	2.09	2.16ab
S2	0.60	1.12	2.14	2.26b
A1	0.64	1.11	2.12	2.10
A2	0.56	1.09	2.10	2.14
A3	0.58	1.10	2.04	2.18
A4	07.60	1.09	2.03	2.25

Information: Numbers followed by the same letter in the same column and group mean that they are not different based on Duncan's test at the 5% level.

Table 2 indicates that, after 5 weeks post-planting, the treatment with liquid organic fertilizer (sin) resulted in the most oversized plant stem diameter in treatment s2, which was statistically different from s0 but not significantly different from s1. The diameter of the plant stem in treatment s1 was not substantially different from that in s0. The impact of liquid organic fertilizer on the stem diameter of sweet corn plants at five weeks post-planting is seen in Figure 2.

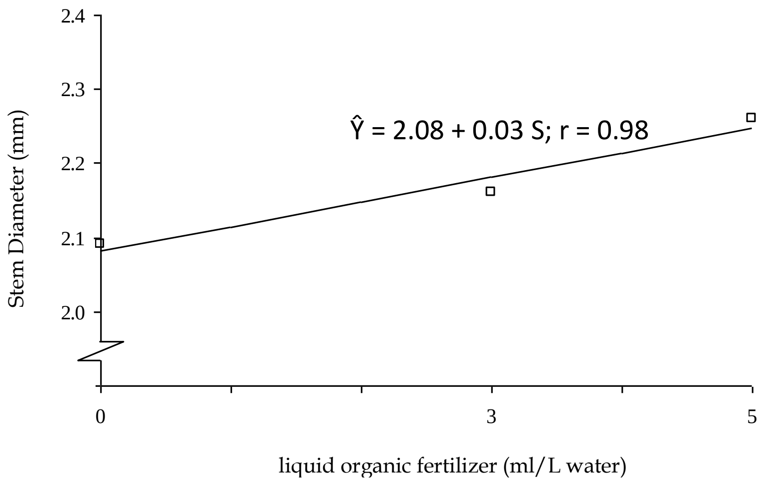

Figure 2. The effect of liquid organic fertilizer doses on the stem diameter of sweet corn plants at 5 weeks after planting

Figure 2 illustrates that increased application of liquid organic fertilizer correlates with a larger diameter of the sweet corn stem, as shown by a positive linear regression curve. Table 2 indicates that the application of chicken manure dosage does not significantly influence the diameter of the sweet corn stem. The maximum sweet corn stem diameter is observed in treatment a4, whereas the minimum is recorded in treatment a1.

Weight of Cob With Husk Per Plant (G)

Data on the weight of cobs with husks per plant as influenced by liquid organic fertilizer (SNN) and manure treatment. The variance analysis indicates that applying liquid organic fertilizer (SNN) significantly influences the weight of cobs with husks per plant. The chicken manure dosage does not significantly influence the weight of cobs with husks per plant. The interaction between the two treatments does not significantly affect the weight of cobs with husks per plant. Table 5 displays the mean weight of cobs with husks per plant resulting from various treatments of liquid organic fertilizer (SNN) and chicken manure.

Table 3. Average weight of cobs with husks per plant (g) in liquid organic fertilizer (SNN) and chicken manure treatments

treatment	a1	a2	a3	a4	average
s0	348.89	328.33	259.44	362.56	324.81a
s1	358.44	343.00	345.56	316.11	340.78ab
s2	347.78	395.00	382.22	402.22	381.81b
average	351.70	355.44	329.07	360.30	

Information: Numbers followed by the same letter in the same column and group mean no difference based on the Duncan test at the 5% level.

Table 3 indicates that in the liquid organic fertilizer (SNN) treatment, the maximum weight of cobs with husks per plant was seen in treatment S2, which was statistically different from S0 but not significantly different from S1. The weight of cobs with husks per plant in treatment S1 was not statistically different from that in S0. Figure 3 illustrates the impact of liquid organic fertilizer on the weight of cobs with husks per plant.

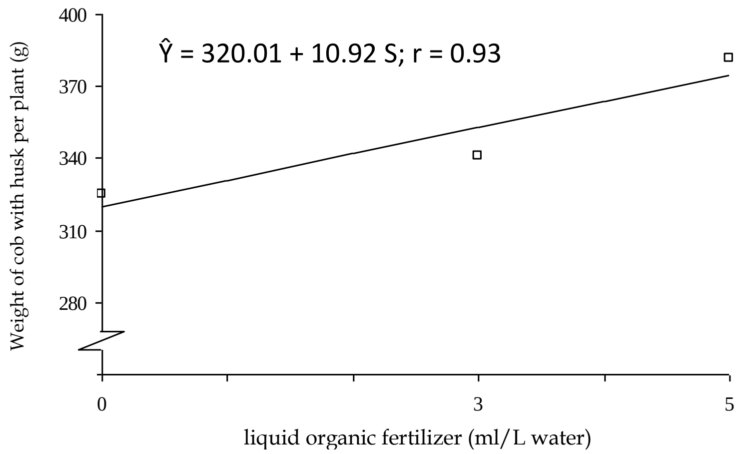

Figure 3. The effect of liquid organic fertilizer dosage on the weight of cobs with husks per plant

Figure 3 illustrates that increased application of liquid organic fertilizer correlates positively with the weight of cobs with husks per plant, following a linear regression trend. Table 3 indicates that the application of chicken manure dosage does not significantly influence the weight of cobs with husks per plant.

Treatment a4 exhibits the maximum weight of cobs with husks per plant, whereas treatment a3 has the lowest weight.

DISCUSSION

The Effect of SNN Liquid Organic Fertilizer on Sweet Corn Growth and Production

The analysis of the variance test indicates that the application of liquid organic fertilizer SNN significantly affects plant height, stem diameter, and cob weight with husk per plant. The findings indicated that applying liquid organic fertilizer SNN significantly influenced growth at 2 and 3 weeks post-planting but had no significant impact at 4 and 5 weeks post-planting. During the vegetative growth phase, particularly at the onset of plant development, plants necessitate substantial nutrients; thus, applying liquid organic fertilizer can enhance plant height. By weeks four and five post-planting, sweet corn plants transition into the generative phase, wherein the nutrients absorbed are predominantly allocated to generative growth processes, such as flower formation. At three weeks post-planting, liquid organic fertilizer at 5 ml/l of water per plot may enhance plant height by 90.97 cm. Using liquid organic fertilizer has shown its impact on plant height and the development of sweet corn plant organs at 2 and 3 weeks post-planting. Sweet corn plants start their last vegetative stage at 8 weeks post-planting, resulting in a cessation of height growth. The study's findings indicated that plant height development was sluggish at 2 and 3 weeks post-planting but accelerated significantly at 4 and 5 weeks post-planting. At 2 and 3 weeks post-planting, maize plants undergo a sluggish development period, during which their roots remain underdeveloped and do not actively absorb nutrients. (Mahdiannoor et al., 2016) said that the growth rate would initially be sluggish and accelerating, with more significant organisms exhibiting quicker growth rates.

During their development, maize plants need enough nutrients. Nutrients are essential for promoting overall plant growth, enhancing vegetative development, and facilitating plant synthesis of amino acids and proteins. Nutrients, including chlorophyll, nucleic acids, and enzymes, are essential for synthesizing critical molecules. Nutrients are required in substantial amounts at all developmental stages, particularly during the vegetative phase, which includes shoot production and the development of stems and leaves (Lamakoma et al., 2019). The contribution of phosphorus in vegetative plant development is around 0.3 - 0.5%. Phosphorus (P) enhances plant root development; nevertheless, although it may boost root density, its effect is not as pronounced as that of nitrogen (N). The function of potassium in vegetative plant development is to enhance assimilate transport, save water by controlling stomatal opening and closure, and bolster plant resistance to pests and diseases.

The study's findings indicated that progressively increased liquid organic fertilizer may enhance the weight of the cob with husks per plant. The liquid organic fertilizer comprises nitrogen, phosphorus, and potassium nutrients, which corn plants may effectively and optimally absorb. The augmented supply of nutrients may fulfill the nutritional requirements of maize plants. Nutrients phosphorus and potassium are crucial for the reproductive growth of maize plants, namely in the development of cob weight and length. Nutrient P significantly influences cob development. Phosphorus may enhance fruit development; moreover, its availability as an ATP precursor ensures a consistent energy supply for growth, facilitating the synthesis of assimilates and their delivery to storage. This results in the cobs generated having a substantial diameter. The increase in cob diameter is associated with phosphorus availability. (Tarigan, 2024) said that enough phosphorus in corn plants enhances the development of maize cobs, resulting in bigger sizes and fully populated rows of seeds. Nutrient K is essential for carbohydrate generation and storage. Hence, plants that generate substantial carbs have elevated potassium requirements (Gardner et al., 1991). (Fitriyah et al., 2024) said that the role of potassium is to enhance fruit quality during the generative phase. (Tarigan, 2024) asserted that nutrient availability significantly influences cob weight, particularly the seeds, as the nutrients absorbed by the plant contribute to the synthesis of proteins, carbohydrates, and fats, which are subsequently stored in the seeds, thereby augmenting cob weight.

The Effect of Chicken Manure on the Growth and Production of Sweet Corn Plants

The analysis of variance indicates that chicken manure does not significantly affect plant height, stem diameter, or cob weight with husks per plant. The impact of manure treatment is not substantial across all measured parameters. The influence of chicken manure enhances the physical properties of the soil; however, the chemical properties remain unimproved due to suboptimal utilization by plants. Chicken manure is a slow-release fertilizer available to plants only after decomposition. The growth and yield of sweet corn plants tend to rise with the application of more significant quantities of manure. (Nehe, 2020) assert that incorporating chicken manure into soil cultivated with maize promotes robust growth and fertility of the corn plants. Chicken dung is superior to other organic fertilizers; this solid organic fertilizer decomposes rapidly, promoting plant development. Chicken dung is a superior organic substance that decomposes rapidly or is readily accessible to plants. The carbon-to-nitrogen ratio of the soil determines the efficacy of supplying chicken manure. A lower C/N ratio in the soil accelerates the decomposition of manure into essential nutrients for plants, promoting plant development.

Interaction between Liquid Organic Fertilizer (SNN) and Chicken Manure on the Growth and Production of Sweet Corn Plants

The analysis of variance findings indicated that the interaction between liquid organic fertilizer (SNN) and chicken manure did not significantly affect any of the measured parameters. The application of chicken manure did not significantly impact the development and yield of sweet corn plants; hence, the combined treatment effects were solely determined by the action of the liquid organic fertilizer SNN.

This part allows you to elaborate on your results findings academically. You must not put numbers related to your statistical tests here; instead, you have to explain that numbers here. You have to compile your discussion with academic supports to your study and a good explanation according to the specific area you are investigating.

CONCLUSIONS AND RECOMMENDATIONS

Application of liquid organic fertilizer SNN 5 ml/l of water per plot substantially influenced plant height, stem diameter, and the weight of cobs with husks per plant. The application of 2.5 kg of chicken manure per plot (equivalent to 16.5 tons per hectare) did not have a significant impact on plant height, stem diameter, or the weight of cobs with husks per plant. The interaction between the liquid organic fertilizer SNN and chicken manure did not substantially influence any of the investigated parameters. Recommendation: More studies are required to enhance the use of liquid organic fertilizer (SNN) and chicken manure to improve the development and yield of sweet corn plants.

FURTHER STUDY

Future research should explore the long-term effects of repeated applications of SNN liquid organic fertilizer and chicken manure on soil microbial diversity, nutrient cycling efficiency, and environmental sustainability. Incorporating metagenomic analysis to observe changes in the soil microbiome can provide insights into how organic treatments impact biological soil health. Additionally, integrating precision agriculture tools such as remote sensing and sensor-based nutrient monitoring can optimize the dosage and timing of organic input applications. Exploring synergistic combinations with biofertilizers or mycorrhizal fungi may further enhance nutrient uptake and resilience in sweet corn cultivation under varied climatic and soil conditions.

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