



The Effect of Compost and KCl Fertilizer Dosage on the Growth and Productivity of Sweet Corn (*Zea mays Saccharata Sturt L.*)

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Abstract: This study aimed to evaluate the effect of compost fertilizer and potassium chloride (KCl) fertilizer, as well as their interaction, on the growth and yield of sweet corn (*Zea mays saccharata Sturt*). The experiment was conducted from May to August 2022 in Kuning Village, Babel District, Southeast Aceh, using a factorial randomized block design with two factors: compost dosage (480 g/plot, 960 g/plot, 1,440 g/plot) and KCl dosage (20 g/plot, 40 g/plot, 60 g/plot), each replicated three times for a total of 27 plots. Observed parameters included plant height, stem diameter, leaf area, days to flowering, ear length, and ear weight per plot. Results indicated that compost and KCl fertilizers significantly affected plant height, leaf area, days to flowering, and ear length, but had no significant effect on stem diameter or ear weight per plot. The interaction between compost and KCl produced the highest plant height (165.89 cm) and ear length (21.69 cm) in treatment K3C1. The findings suggest that optimal fertilization using compost and KCl can enhance sweet corn productivity by improving vegetative growth and reproductive development. Nevertheless, the absence of significant effects on stem diameter and ear weight per plot indicates that nutrient balance, especially nitrogen (N) and phosphorus (P), remains crucial for maximizing yields. Therefore, integrating compost and KCl with complementary sources of macronutrients could promote more consistent outcomes. This research also highlights the role of organic matter in enriching soil fertility, maintaining soil structure, and supporting sustainable agriculture. The combination of organic and inorganic fertilizers demonstrates the potential for eco-friendly crop management practices that balance productivity with environmental responsibility. These results provide valuable insights for farmers, agronomists, and policymakers in developing efficient fertilization strategies for sweet corn cultivation within local conditions.

Keywords: Compost Fertilizer, KCl Fertilizer, Sweet Corn

1. INTRODUCTION

Sweet corn (*Zea mays saccharata Sturt*) is one of the vegetable crops favored by the public due to its sweet and pleasant taste, as well as its health benefits. It contains abundant nutrients such as carbohydrates, proteins, fats, several vitamins and minerals, and has a relatively high sugar content. Sweet corn has a sugar content ranging from 13–15 °Brix (Syukur et al., 2014).

Sweet corn is one of the food commodities that plays a strategic role in the national economy. Its production period (harvest age) is relatively short, about 60–70 days, making it highly profitable. Sweet corn can be processed into fresh products such as boiled corn, fritters, corn chips, corn pudding, corn omelets, and various other corn-based products (Said, 2008). Sweet corn is classified as a horticultural crop, although morphologically it is not different from field corn (*Zea mays L.*). It is derived from the development of flint corn (pearl corn) and dent corn (horse-tooth corn). Sweet corn is a highly popular agricultural commodity because of its delicious sweet taste, its high content of carbohydrates, proteins, vitamins, and its sugar content of 5–6%, which is higher than that of regular corn, which contains only 2–3% sugar.

In addition, its shorter production cycle makes it highly advantageous both economically and in terms of health (Harizamrry, 2007).

Agricultural practices that rely heavily on chemical inputs such as inorganic fertilizers and chemical pesticides—practices that have been widespread in the past and continue today—have caused many negative impacts, not only on humans but also on the environment and other living organisms. Another negative effect of chemical-based farming is the contamination of agricultural products with chemical residues, which can be harmful to health. Recognizing this, efforts are needed to eliminate or at least reduce chemical contamination in the human body and the environment. Fertilization generally aims to maintain or improve soil fertility so that plants can grow more quickly, vigorously, and healthily. According to Roesmarkam and Yuwono (2002), fertilization is intended to replace nutrients lost from the soil medium and is one of the key efforts to improve plant growth and yield.

To improve soil fertility, it is necessary to apply a balanced combination of organic and inorganic fertilizers to help farmers increase sweet corn yields (Rosmarkam et al., 2002). Fertilization is one of the main efforts to increase corn production. There are two types of fertilizers available in the market: inorganic fertilizers and organic fertilizers. Inorganic fertilizers are the result of chemical, physical, or biological engineering processes, typically produced industrially. Organic fertilizers are derived mostly or entirely from plant and animal materials that have undergone decomposition or processing, available in solid or liquid form, and are used to supply organic matter and improve the physical, chemical, and biological properties of the soil (Dewanto et al., 2013).

Farmers generally apply chemical (inorganic) fertilizers to corn crops continuously and in increasing doses. The use of chemical fertilizers without organic fertilizers is considered unwise, particularly for sustainable agricultural practices. Prolonged application of high doses of chemical fertilizers can damage soil microorganisms, and if left unchecked, will destroy the soil's natural fertility (Adijaya, 2010).

An alternative agricultural system to preserve natural resources is to limit the use of inorganic fertilizers and promote the use of organic fertilizers (Martani et al., 2002). One commonly used organic material for improving soil fertility is manure, which is widely available. Compost is an organic fertilizer derived from decomposed plant residues and animal manure. Compost improves soil fertility by repairing the physical damage caused by excessive use of inorganic fertilizers, which can degrade soil structure in the long term. One example of compost is vermicompost (Prihandini, 2007).

Applying compost can improve soil structure, maintain soil stability and aeration, with recommended application rates of 2–5 tons/ha (Khrisnawati, 2003). In addition to supplying nutrients, compost contains many microorganisms and plant growth hormones such as gibberellin (2.75%), cytokinin (1.05%), and auxin (3.80%). The large number and high activity of microbes can accelerate the release of nutrients from vermicompost into forms available to plants. Meanwhile, plant growth regulators at certain concentrations can influence plant growth and development (Mulat, 2005).

In this study, potassium (K) was provided in the form of KCl fertilizer. Potassium in KCl is one of the essential macronutrients required by plants in relatively large amounts. Potassium functions in the formation of sugars and starches, sugar translocation, enzyme activation, and stomatal regulation (Pradipta, Wicaksono, & Guritno, 2014). According to Somputan (2014), potassium in plant tissues exists in the form of cations, ranging from 1.7% to 2.7% of the dry weight of normally grown leaves. Potassium ions in plants act as activators for many enzymes involved in several plant metabolic processes.

In soil fertility, the balance of potassium with other elements is important due to the physiological nature of plants that often require potassium in proportion to other nutrients. Potassium also has antagonistic properties with some elements. Imbalances between potassium and other nutrients can cause deficiency symptoms in one or more elements. Potassium loss in soil can occur through harvesting, leaching, erosion, and fixation. Potassium loss due to crop removal occurs because potassium can be absorbed excessively by plants beyond their actual needs. This excessive uptake does not further increase crop yield and results in waste of soil potassium (Rosmarkam et al., 2002).

In this study, KCl fertilizer at 100–300 kg/ha did not improve all observed variables but did influence plant height, number of leaves, stem diameter, leaf area, ear weight per plant, yield per plot, and yield per hectare (Onzie Sevinda, 2015). Potassium in plants, in cation form, plays an important role in respiration and photosynthesis, and can also increase sugar content (Taiz & Zeiger, 2002). Potassium is very important for the growth and development of corn. Approximately 25% of potassium is found in the kernels after harvest, while the remainder is in the stalks and cobs. This aligns with research findings that young plants do not require much potassium, but their needs rise sharply before tassel emergence (Tim Penulis PS, 2002). This study aims to determine the effect of compost fertilizer dosage and KCl fertilizer dosage on the growth and productivity of sweet corn (*Zea mays saccharata* Sturt).

2. METHOD

RESEARCH HYPOTHESES

- a. It is hypothesized that the application of compost fertilizer affects the growth and yield of sweet corn plants.
- b. It is hypothesized that the application of KCl fertilizer affects the growth and yield of sweet corn plants.
- c. It is hypothesized that there is an interaction effect between compost fertilizer and KCl fertilizer on the growth and yield of sweet corn plants.

Research Benefits

- a. As a source of data for the preparation of an undergraduate thesis to fulfill the requirements for obtaining a Bachelor's degree in the Agrotechnology Study Program, Faculty of Agriculture, Universitas Gunung Leuser, Kutacane.
- b. As reference material for the development of agricultural science and as additional knowledge for parties in need, particularly in preparing a thesis on sweet corn cultivation.

Research Site And Period

This research will be conducted from May to August 2022 in Kuning Village, Babel District, Southeast Aceh Regency, at an altitude of approximately 220 meters above sea level.

Research Tools And Materials

Tools: Hoe, knife, measuring tape, analytical balance, and other writing instruments to support the research. Materials: Sweet corn seeds, compost fertilizer, KCl fertilizer, raffia rope, zinc sheets, paper, and other necessary materials for this research.

Research Methods

This study uses a factorial Randomized Block Design (RBD), as follows:

Factor 1: Compost fertilizer dosage (K) with three levels:

K1 = 480 g/plot

K2 = 960 g/plot

K3 = 1,440 g/plot

Factor 2: KCl fertilizer dosage (C) with three levels:

C1 = 20 g/plot

C2 = 40 g/plot

C3 = 60 g/plot

Thus, there are $3 \times 3 = 9$ treatment combinations, each repeated three times, resulting in a total of 27 plots.

Data Analysis Method

Data analysis was carried out using analysis of variance (ANOVA) with the following linear model:

$$Y_{ijk} = \mu + k_i + \lambda_j + \beta_k + (\lambda\beta)_{jk} + \epsilon_{ijk}$$

Where:

- a. Y_{ijk} = Observation result for compost level j and KCl level k in replication i
- b. μ = Overall mean
- c. k_i = Effect of replication i
- d. λ_j = Effect of compost level j
- e. β_k = Effect of KCl level k
- f. $(\lambda\beta)_{jk}$ = Interaction effect between compost level j and KCl level k
- g. ϵ_{ijk} = Error term for compost level j and KCl level k in replication i

Research Implementation

Land Preparation

Land preparation began by clearing the research site of debris, weeds, and plant roots. After the area was clean, the soil was dug to a depth of 20 cm, clods were broken up, and the soil was leveled. Experimental plots measuring 1 m × 1.5 m were prepared, with 50 cm spacing between plots and a plot height of 10 cm.

Planting

Planting was done by dibbling to a depth of 3 cm, with spacing of 70 cm × 25 cm. One sweet corn seed was planted per hole, then covered with soil.

Fertilizer Application

Fertilizers were applied by mixing compost and KCl according to the treatment dosages. The fertilizers were placed in dibble holes 5 cm away from the seeds.

Observation Parameters

- a. Plant Height (cm)
Measured from the soil surface to the tip of the youngest leaf using a ruler or tape measure. Measurements were taken from 2 to 5 weeks after planting (WAP) at one-week intervals.
- b. Stem Diameter (mm)
Measured using calipers at the plant base. Measurements began at 2 WAP and continued weekly until 5 WAP.

c. Leaf Area (cm²):

Measured manually using the formula: $\text{Leaf area} = (\text{length} \times \text{width}) \times 0.75$. The 7th leaf was measured from base to tip for length and at the widest point for width, using a measuring tape. Measurements were taken at 5 WAP.

d. Days to Flowering

Recorded from planting until the first tassel emergence, measured in days.

e. Ear Length (cm)

Measured after harvest and husk removal, from the base to the tip of the ear using a ruler.

f. Ear Weight per Plot (g)

Measured at harvest by weighing the total ear weight per plot using a scale.

3. RESULTS AND DISCUSSION

Results

a. Plant Height (cm)

The data on plant height observations and analysis of variance (ANOVA) at 60 days after planting (DAP) can be seen in the Appendix. From the ANOVA table in the Appendix, it is evident that the treatments of compost fertilizer dosage, KCl fertilizer dosage, and their interaction had a highly significant effect on plant height. The mean plant height at 60 DAP (cm) under different compost and KCl fertilizer dosages for sweet corn growth and productivity is presented in Table 1.

Table 1. Mean Plant Height at 60 DAP (cm) under Compost and KCl Fertilizer Dosages for Sweet Corn Growth and Productivity

Pelakuan	C1	C2	C3	Rataan
K1	158.22 a	160.89 a	158.44 a	159.19 a
K2	159.78 a	159.22 a	158.44 a	159.15 a
K3	165.89 bc	162.67 b	162.33 a	163.63 b
Rataan	161.30 a	160.93 a	159.74 a	

Source: Processed data by the author, 2022

From Table 1, it can be seen that the tallest sweet corn plants were obtained from treatment K3C1 (165.89 cm), which was significantly different from the other treatments. The shortest plants were found in treatment K1C1 (158.22 cm). These differences are illustrated in Figure 1.

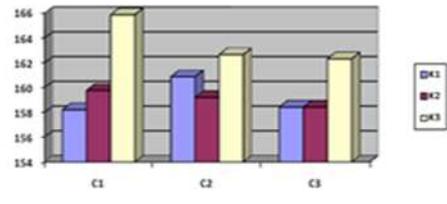


Figure 1. Plant Growth

Source: Processed data by the author, 2022

b. Stem Diameter (mm)

The data on stem diameter at 5 weeks after planting (WAP) can be found in the Appendix. The F-test results in the ANOVA table indicate that compost and KCl fertilizer dosages had no significant effect on stem diameter.

The mean stem diameter at 5 WAP under different compost and KCl fertilizer dosages is presented in Table 2.

Table 2. Mean Stem Diameter at 5 WAP (mm) under Compost and KCl Fertilizer Dosages for Sweet Corn Growth and Productivity

Perlakuan	C1	C2	C3	Rataan
K1	18.12 a	18.06 a	18.17 a	18.11 a
K2	18.10 a	18.16 a	18.12 a	18.13 a
K3	18.66 bcd	18.51 bc	18.49 bc	18.55 bc
Rataan	18.29 a	18.24 a	18.26 a	

Source: Processed data by the author, 2022

From Table 2, the largest stem diameter was obtained from treatment K3C1 (18.66 mm), which was not significantly different from the other treatments. The smallest stem diameter was found in treatment K1C2 (18.06 mm). These differences are illustrated in Figure 2.

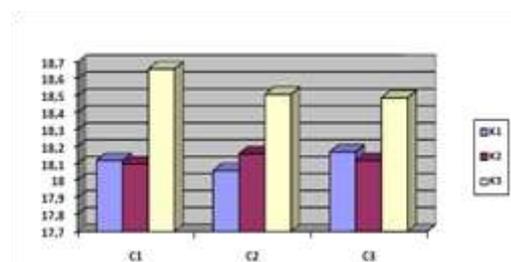


Figure 2. Stem Diameter of Sweet Corn Plants

Source: Processed data by the author, 2022

c. Leaf Area (cm²)

The data on leaf area at 5 WAP are shown in the Appendix. The F-test results indicate that compost and KCl fertilizer dosages had a significant effect on leaf area.

The mean leaf area of sweet corn plants, as analyzed using the Honestly Significant Difference (HSD) test, is presented in Table 3.

Table 3. Mean Leaf Area at 5 WAP (cm²) under Compost and KCl Fertilizer Dosages

Perlakuan	C1	C2	C3	Rataan
K1	2189.67 a	2227.00 a	2276.89	2231.19 a
K2	2269.67 bc	2268.22 bc	2284.44 bc	2274.11 bc
K3	2301.56 bc	2289.78 bc	2289.22 bc	2293.52 bc
Rataan	2253.63 bc	2261.67 bc	2283.52 bc	

Source: Processed data by the author, 2022

From Table 3, the largest leaf area was obtained from treatment K3C1 (2301.56 cm²), which was significantly different from the other treatments. The smallest leaf area was found in treatment K1C1 (2189.67 cm²). These differences are illustrated in Figure 3.

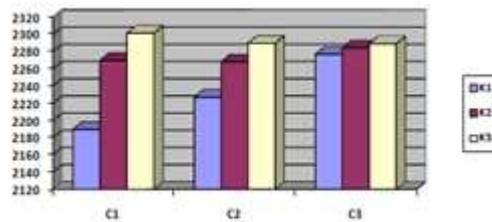


Figure 3. Effect of Compost Fertilizer on Leaf Area

Source: Processed data by the author, 2022

d. Days to Flowering (days)

The data on days to flowering at 60 DAP are shown in the Appendix. The F-test results indicate that compost and KCl fertilizer dosages significantly affected the number of days to flowering. The mean days to flowering of sweet corn plants, as analyzed using the HSD test, is presented in Table 4.

Table 4. Mean Days to Flowering of Sweet Corn under Compost and KCl Fertilizer Dosages

Perlakuan	C1	C2	C3	Rataan
K1	56.78 a	57.44 bcd	57.00 a	57.07 b
K2	57.11 b	57.22 bc	57.00 a	57.11 b
K3	56.89 a	56.89 a	57.00 a	56.93 a
Rataan	56.93 a	57.19 b	57.00 a	

Source: Processed data by the author, 2022

From Table 4, the shortest time to flowering was recorded in treatment K1C2 (57.44 days), which was not significantly different from the other treatments. The longest time to flowering was in treatment K1C1 (56.78 days). These differences are illustrated in Figure 4.

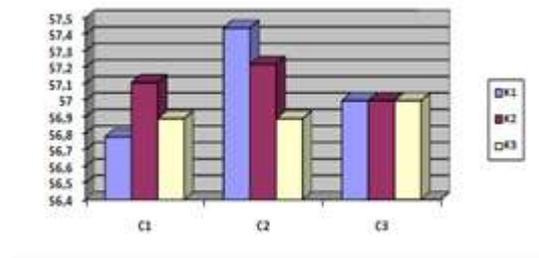


Figure 4. Flowering of Sweet Corn Plants

Source: Processed data by the author, 2022

e. Ear Length (cm)

The data on ear length are presented in the Appendix. The F-test results show that compost and KCl fertilizer dosages had a significant effect on ear length. The mean ear length of sweet corn plants, as analyzed using the HSD test, is presented in Table 5.

Table 5. Mean Ear Length (cm) under Compost and KCl Fertilizer Dosages

Perlakuan	C1	C2	C3	Rataan
K1	18.33 a	18.52 a	19.71 bc	18.85 a
K2	19.97 bc	19.81 bc	19.81 bc	19.86 bc
K3	21.69 bcd	21.20 bcd	21.55 bcd	21.48 bcd
Rataan	20.00 bc	19.84 bc	20.36 bc	

Source: Processed data by the author, 2022

From Table 5, the longest ear length was obtained from treatment K3C1 (21.69 cm), which was significantly different from the other treatments. The shortest ear length was found in treatment K1C1 (18.33 cm). These differences are illustrated in Figure 5.

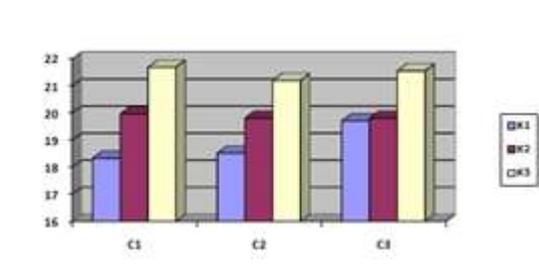


Figure 5. Ear Length of Sweet Corn Plants

Source: Processed data by the author, 2022

f. Ear Weight per Plot (g)

The data on ear weight per plot are shown in the Appendix. The F-test results indicate that compost and KCl fertilizer dosages had no significant effect on ear weight per plot.

The mean ear weight per plot, as analyzed using the HSD test, is presented in Table 6.

Table 6. Mean Ear Weight per Plot (g) under Compost and KCl Fertilizer Dosages

Treatment	C1	C2	C3	Mean
K1	2.009a	2.101b	2.171b	2.093a
K2	2.206bc	2.256bcd	2.269bcd	2.243bcd
K3	2.353bcdef	2.330bcde	2.303bcde	2.329bcde
Mean	2.189b	2.229bc	2.247bc	

Source: Processed data by the author, 2022

Note: Values followed by the same letter within the same column are not significantly different according to the 5% HSD test.

From Table 6, the highest ear weight was obtained from treatment K3C1 (2.353 g), which was significantly different from the other treatments. The lowest ear weight was recorded in treatment K1C1 (2.009 g). These differences are illustrated in Figure 6.

Petakuan	C1	C2	C3	Rataan
K1	2,009 a	2,101 b	2,171 b	2,093 a
K2	2,206 bc	2,256 bcd	2,269 bcd	2,243 bcd
K3	2,353 bcdef	2,330 bcde	2,303 bcde	2,329 bcde
Rataan	2,189 b	2,229 bc	2,247 bc	

Figure 6. Effect of Compost Fertilizer on Ear Weight per Plot

Source: Processed data by the author, 2022

DISCUSSION

Plant Height

The significant effect on the height of sweet corn plants suggests that the application of compost and KCl fertilizer dosages had a real impact on sweet corn growth and productivity. This is likely because, in the early growth stage (2 WAP), there was no competition among plants. However, by 3–6 WAP, the root systems had developed and were actively absorbing the nutrients available in the soil, meeting the plants’ needs for height growth. Nutrient uptake during the growth period does not occur in equal amounts; therefore, it must be supplied gradually in amounts suitable for plant requirements. There are certain periods when growth is rapid and vigorous, leading to high nutrient absorption.

Noza et al. (2014) stated that plant height increase is caused by cell division and elongation, predominantly occurring in the shoot tips. The improved plant growth in this study was due to the application of compost and KCl fertilizers to the planting medium. As the plants aged, their growth increased correspondingly. According to Saragih et al. (2013), higher nitrogen application affects plant height, with more nitrogen resulting in taller plants. This is related to nutrient adequacy, as nitrogen is essential during the early vegetative phase of corn growth.

Stem Diameter

Table 2 shows that the highest mean stem diameter did not significantly differ among compost and KCl fertilizer dosages. This suggests that compost and KCl fertilizers had minimal influence on stem diameter growth. The slower growth in stem diameter compared to other treatments, despite containing N, P, and K, may be due to nutrient allocation. In the early planting phase, nutrients are allocated more toward height growth, and as plants near the end of the vegetative phase, nutrients are directed toward stem diameter development. Compost and KCl fertilizers are important for stimulating stem diameter growth (Puspadewi et al., 2016).

Leaf Area

Table 3 shows that the highest mean leaf area differed significantly from other treatments. Leaf surface area is affected by plant competition, which occurs when growth factors such as nutrients, water, and light are limited. Dinariani et al. (2014) stated that broad, flat leaves allow plants to capture maximum sunlight per unit volume. The rate of photosynthesis is determined by leaf area; the larger the leaf area, the more sunlight is absorbed, leading to increased photosynthetic activity. Nitrogen fertilization increases yield, protein content, and cellulose content, while CO₂ assimilation products are converted to carbohydrates and stored in plant tissues.

Days to Flowering

The results indicate no significant effect of compost and KCl fertilizer on days to flowering. This may be because the fertilizers were not fully effective in supporting leaf area development, or because nutrient uptake was not yet balanced.

Leaves play a vital role in nutrient storage and assimilation, which are used to enhance leaf length and density.

Ear Length

Table 6 shows that compost and KCl fertilizer dosages significantly affected ear length, with treatment K3C1 (21.69 cm) producing the longest ears. According to Prasetyo et al. (2013), after flowering and during kernel filling, corn requires large amounts of nutrients for

proper kernel development. Nutrient deficiency at this stage can result in incomplete kernel formation, smaller kernel size, and poorly filled ear tips.

Ear Weight per Plot (g)

Table 6 shows no significant effect of compost and KCl fertilizer dosages on ear weight per plot. However, better plant growth generally leads to higher yields, which is linked to greater nutrient availability in the soil, especially macronutrients. According to Kriswantoro et al. (2016), fertilizer plays a role in protein synthesis, shoot growth, vegetative development, flower and fruit formation, root elongation, and drought tolerance. Compost and KCl fertilizers contribute to essential metabolic processes such as photosynthesis and respiration. Phosphorus is crucial for ear formation, kernel filling, and accelerating kernel maturity, while potassium is vital during tassel emergence.

4. CONCLUSIONS AND RECOMMENDATIONS

Conclusions, Compost fertilizer had a highly significant effect on plant height, no significant effect on stem diameter, and a significant effect on other parameters. KCl fertilizer had a highly significant effect on plant height, no significant effect on stem diameter, and a significant effect on other parameters. There was a highly significant interaction effect on plant height, no significant effect on stem diameter, and a significant effect on other parameters. Recommendations: Additional basal N, P, and K fertilizers are recommended, as the low yield suggests a deficiency of these nutrients in the soil. Extending the harvesting period should be considered.

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