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Effect of Manure and Potassium Fertilizer on the Growth, Yield, and Quality of Sweet Corn (*Zea mays saccharata*)

Suwinda Fibriani [1*], Tiara Ayu Nugraha Putri [2] and Fitri Krismiratsih[2]

[1,2,3] Dpartement Agribussines Management, Politeknik Negeri Jember

[*] Correspondence: suwinda@polije.ac.id

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Abstract: This study aimed to determine the effect of manure and potassium fertilizer application on the growth and yield of sweet corn (*Zea mays saccharata*). The experiment was conducted in Ringinanom Village, Nganjuk Regency, from June to August 2025 using a Randomized Block Design (RBD) with two factors: manure dosage (0, 4, 8, and 12 kg/plot) and potassium fertilizer dosage (0, 3, 5, and 6 g/plant). The results showed that both manure and potassium fertilizers significantly affected plant growth and yield. For plant height, manure at 4–8 kg/plot resulted in the best growth up to the late vegetative stage (44 days after planting). The highest number of leaves was obtained from the combination of 12 kg/plot manure and 5 g/plant potassium fertilizer. At the generative stage, potassium at 5 g/plant produced the longest ear (20.33 cm) and the largest ear diameter (4.91 cm). These findings indicate that combining organic manure with potassium fertilizer enhances nutrient uptake efficiency, photosynthetic activity, and generative organ formation. Agronomically, the integration of organic and inorganic fertilizers effectively improves soil fertility and optimizes sweet corn productivity.

Keywords: Manure Fertilizer, Pottasium Fertiliser, Sweet Corn, Yield

1. Introduction

Sweet corn (*Zea mays saccharata*) is one of the most valuable horticultural commodities in Indonesia, offering both high economic returns and strong potential for wider development. Market demand for sweet corn continues to rise thanks to its high sugar content, pleasant sweetness, crisp texture, and rich nutritional value particularly in vitamins and minerals (Alfian and Purnamawati, 2019). However, sweet corn productivity across the country remains inconsistent and generally falls short of the potential yield of hybrid varieties, which can reach 8–12 tons per hectare (Badan Litbang Pertanian, 2021). This relatively low productivity is often linked to limited soil nutrient availability and inefficient fertilization practices (Setyaji *et al*., 2024).

The increasing demand for sweet corn should ideally be matched by productivity improvements through more sustainable cultivation practices. A key challenge in sweet corn production is the low efficiency of fertilizer use and the gradual decline in soil quality caused by the excessive and continuous application of chemical fertilizers (Firmansyah & Kusma, 2021). Fertilization whether organic or inorganic plays a central role in supporting balanced nutrient availability for plant growth. Among the major macronutrients (N, P, and K), potassium is particularly important as it directly influences both yield and cob quality in sweet corn (Thamrin & Hama, 2022). Long-term reliance on synthetic fertilizers has been shown to degrade soil structure, suppress beneficial microbial activity, and contribute to environmental pollution. The use of organic manure offers a promising alternative, as it contains a balanced composition of macro- and micronutrients along with beneficial microorganisms. These components help improve soil texture, enhance cation exchange capacity (CEC), and stimulate microbial activity essential for decomposition and nutrient cycling processes that sustain healthy plant growth.

In addition, potassium (K) is one of the essential macronutrients required by corn, particularly during the cob formation and grain-filling stages. Potassium plays a crucial role in regulating cellular water balance, enhancing photosynthetic efficiency, stimulating sugar synthesis, and strengthening plant tissues to withstand both abiotic and biotic stresses (Shakoor et al., 2015). Previous studies have shown that the integrated application of organic and inorganic fertilizers tends to produce better results than the use of either source alone. The combination of manure and potassium fertilizer is expected to improve soil properties and provide an optimal supply of nutrients to support the growth and yield of sweet corn (Rahem et al., 2021). The synergy between manure and potassium is anticipated to enhance the plant's ability to absorb potassium efficiently, while potassium contributes directly to improved cob development and overall yield quality. However, the response of sweet corn to different levels of manure and potassium application has not been fully understood. Therefore, further research is needed to examine the interaction effects between organic manure and potassium on the growth, yield, and quality of sweet corn. The findings of this study are expected to contribute to the development of productive, efficient, and sustainable sweet corn cultivation technologies.

2. Materials and Methods

The The research was conducted from June to August of 2025 at the experimental field located in Ringinanom Village, Nganjuk District, Nganjuk Regency. The materials utilized in this study encompassed hybrid corn seeds of the Virginia variety (obtained from Tunas Agro), potassium chloride (KCl) fertilizer, goat manure, urea, trisodium phosphate (TSP) as a basal fertilizer, pesticides, sample markers, and water. The instruments utilized in this study encompassed a range of tools, including hoses, machetes, watering cans, measuring tapes, and an analytical balance.

The present study employed a Factorial Randomized Block Design (RBD), consisting of two factors. The first factor was the application of KCl fertilizer, with four levels of treatment: The experiment included four distinct treatments: A1, representing the control, A2, which provided 1.5 grams per plant, A3, which provided 3 grams per plant, and A4, which provided 6 grams per plant. The second factor was goat manure application, which was also subjected to four distinct treatment levels: In the experiment, the first treatment, B1, served as the control. The second treatment, B2, involved the application of goat manure at the recommended rate of 4 kilograms per plot. The third treatment, B3, involved the application of goat manure at twice the recommended rate, which was 8 kilograms per plot. The fourth treatment, B4, involved the application of goat manure at three times the recommended rate, which was 12 kilograms per plot.

The research activities were conducted from the planting stage through the harvest, encompassing both the vegetative and generative growth phases. The activities encompassed a range of tasks, including land preparation, plot establishment, the preparation of tools and planting materials, the application of fertilizers, and the maintenance of crops. The parameters that were observed in this study included plant height (PH), the number of leaves (NL), ear length (EL), and ear diameter (ED). Subsequently, the collected data were subjected to analysis using Duncan's Multiple Range Test (DMRT) at a 5% significance level.

3. Results and Discussion

a. Plant Height of Sweet Corn

The results of the study indicate that the application of potassium fertilizer and manure had varying effects on the plant height (PH) of sweet corn observed at 14, 24, and 44 days after planting (DAP). Overall, an increase in plant age showed a positive correlation with plant height, suggesting that both potassium and manure play important roles in supporting the vegetative growth of sweet corn. As shown in Table 1.1, the effects of manure and potassium fertilizer treatments on plant height are clearly presented and discussed in detail.

Table 1. Effect of Potassium and Manure Application on Plant Height (cm)

Effect of Potassium and Manure Application on Plant Height								
Time of Observation	Manure application rate (Kg/Plot)				Potassium Application Rate (g/plant)			
	0	4	8	12	0	3	5	6
14 DAP	13.22 b	13.99 a	13.93 a	13.63 a	13.21 c	13.64 b	14.53 a	13.42 bc
24 DAP	22.91 b	24.08 a	23.69 ab	23.40 ab	22.43 c	23.75 b	24.75 a	23.08 bc
44 DAP	61.00 c	73.05 a	69.35 ab	65.90 b	66.17 b	66.55 b	66.55 b	73.93 a

Means followed by different letters within the same row are significantly different based on Duncan's Multiple Range Test (DMRT) at the 5% significance level.

The observations on sweet corn plant height under different levels of manure and potassium fertilizer showed that both treatment factors had a significant effect on the vegetative growth of the plants. In general, plant height increased consistently with plant age, from 14 to 44 days after planting (DAP), reflecting an optimal growth process during the vegetative stage.

The effect of manure application on plant height showed a significant influence on the growth of sweet corn, particularly during the mid to late stages of observation. At 14 days after planting (DAP), plant height did not differ significantly among treatments, ranging from 13.22 to 13.99 cm. This condition indicates that during the early growth phase, nutrients from the manure were not yet fully available to the plants. This finding is consistent with the statement (Meek et al., n.d.) who explained that organic fertilizers require time to undergo decomposition before essential nutrients such as nitrogen, phosphorus, and potassium can be absorbed by plant roots.

At 24 days after planting (DAP), plants treated with 4–8 kg/plot of manure exhibited better growth compared to those without manure application. By 44 DAP, the treatment with 4 kg/plot produced the tallest plants, reaching 73.05 cm, which was significantly higher than the control treatment with a height of only 61.00 cm. This finding indicates that manure plays an important role in improving both the physical and chemical properties of the soil, such as enhancing water-holding capacity, improving soil aeration, and increasing the availability of macro- and micronutrients (Kandil et al., 2020). However, increasing the manure dosage up to 12 kg/plot did not result in a significant improvement in plant height. This phenomenon may be attributed to nutrient saturation or excessive soil moisture, which can reduce the efficiency of nutrient uptake by the roots. Therefore, a dosage range of 4–8 kg/plot can be considered the most efficient level in supporting the vegetative growth of sweet corn.

Observations also revealed that increasing potassium fertilizer rates had a significant effect on sweet corn plant height across all observation periods (Table 1.1). The enhancement in vegetative growth due to potassium application is closely related to the physiological functions of potassium (K) in plants. Potassium acts as an activator for various key enzymes, enhances photosynthetic processes, and regulates water balance through the control of cellular osmotic pressure. In addition, potassium plays a vital role in the translocation of photosynthates from the leaves to other plant organs, thereby supporting stem elongation and tissue expansion (Roy et al., 2020). Optimal potassium availability also enables plants to utilize nitrogen more efficiently, which has a positive impact on plant height growth.

The application of manure and potassium fertilizers significantly affected both the vegetative growth and generative yield of sweet corn. Based on the results, the number of leaves increased with higher doses of manure and potassium up to 44 days after planting (DAP). The combination of 12 kg/plot of manure and 5 g/plant of potassium produced the highest leaf number. This indicates that the availability of macronutrients particularly nitrogen and potassium supports photosynthetic activity and the formation of new leaves. According to(Khomisya et al., 2023), nitrogen plays an essential role in chlorophyll synthesis and vegetative tissue formation, while potassium enhances photosynthetic efficiency and facilitates the translocation of photosynthates to various plant organs.

Table 2. Effect of Potassium and Manure Application on Leaf Number

Effect of Potassium and Manure Application on Leaf Number Daun								
Time of Observation	Manure Application Rate (Kg/Plot)				Pottasium Application Rate (g/tanaman)			
	0	4	8	12	0	3	5	6
14 DAP	5.10 b	6.86 a	6.16 a	6.23 a	5.86 b	5.98 b	6.95 a	5.60 b
24 DAP	7.27 b	5.93 ab	6.20 ab	5.37 b	5.28b	6.85a	5.52b	5.70b
44 DAP	10.65 b	11.76 a	11.41a b	11.80 a	10.89 b	11.05 b	12.06 a	11.53 ab

Means followed by different letters within the same row are significantly different based on Duncan's Multiple Range Test (DMRT) at the 5% significance level.

During the generative phase, potassium fertilizer had a more pronounced effect on ear length and diameter compared to manure. The application of 5 g/plant of potassium produced the longest ears (20.33 cm) and the largest diameter (4.91 cm). This finding is consistent with the statement by Wibowo et al. that potassium plays an important role in ear filling by enhancing carbohydrate synthesis and its translocation to the grains (Wang et al., 2022). Meanwhile, manure primarily functions to improve soil structure and increase nutrient availability, although its effect on yield components tends to be more indirect.

Table 3. Effect of Potassium and Manure Application on diameter of corn plant and lenght of corn cob

Effect of Potassium and Manure Application on diameter of corn plant and lenght of corn cob								
	Dosis Pupuk Kandang (Kg/plot)				Dosis Pupuk Kalium (g/Tanaman)			
Peubah	0	4	8	12	0	3	5	6
Length of corn cob	tn	tn	tn	tn	19.44 ab	19.33 b	20.33 a	18.96 b
Diameter of corn cob	3.95 b	4.59 a	4.54 a	4.57 a	4.51 a	4.27 b	4.91a	4.38 ab

Keterangan: Angka yang diikuti huruf berbeda pada baris yang sama menunjukkan berbeda nyata berdasarkan hasil uji Duncan Multiple Range Test (DMRT) at the 5% significant level

Based on the results of this study, a balanced combination of manure and potassium fertilizer was found to enhance both the vegetative growth and productivity of sweet corn. The availability of nutrients from organic sources, when integrated with inorganic potassium, helps maintain soil fertility and supports the optimal development of corn cob.

4. Conclusions

The application of manure and potassium fertilizer significantly affected the growth and yield of sweet corn. Manure at a rate of 4–8 kg per plot resulted in the best vegetative growth, while potassium fertilizer at 5 g per plant produced the highest number of leaves, as well as the greatest ear length and diameter. The combination of both fertilizers enhanced nutrient uptake efficiency, photosynthetic activity, and the formation of generative organs. Agronomically, integrating organic and inorganic fertilizers is an effective fertilization strategy to improve soil fertility and sustainably increase sweet corn productivity.

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