



## RESEARCH ARTICLE

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# Optimizing the Dose of Cow Manure and Pruning on Sweet Corn (*Zea mays saccharata* Sturt.) Growth and Production

Muhammad Nurdin Hidayat<sup>1</sup>, Sutinisutini<sup>1,\*</sup>, Ramdhan Hidayat<sup>1</sup>

## Abstract

Sweet corn (*Zea mays saccharata* Sturt.) has high economic value; however, its productivity in Indonesia remains low, leading to partial reliance on imports to meet demand. This study aimed to determine the optimal dose of cow manure and pruning method to enhance the growth and yield of sweet corn. The research was conducted in Balongpanggang, Gresik, East Java, from October 2024 to January 2025, using a factorial Completely Randomized Design (CRD) with three replications. The first factor was the dose of cow manure (10, 20, and 30 tons/ha), and the second factor was pruning type (no pruning, pruning three leaves below the cob, pruning male flowers, and pruning both leaves and male flowers). Data were analyzed using ANOVA followed by a 5% BNJ test. The results indicated that the combination of 30 tons/ha of manure with pruning three leaves below the cob and male flowers produced the best outcomes in vegetative growth parameters, including plant height, number of leaves, stem diameter, cob weight, cob diameter, and sweetness content. These findings confirm that integrating organic fertilization with targeted pruning is an effective strategy for sustainably increasing sweet corn productivity.

**Keywords:** Organic Matter, Productivity, RAL, Sweetness Content, Translocation

## 1. Introduction

Sweet corn (*Zea mays saccharata* Sturt) is a widely cultivated horticultural crop known for its higher economic value, greater yield, and faster harvest period compared to field corn. Market demand for sweet corn has been increasing annually. However, to meet this demand, Indonesia still relies on imports, which reached 911,194 tons in 2020 (BPS, 2021). This reliance stems from the low productivity and quality of sweet corn produced by Indonesian farmers. In 2023, the average sweet corn production in Indonesia reached 19.99 million tons (BPS, 2023).

Productivity and quality of sweet corn in Indonesia remain low due to the cultivation land having very low organic matter content and limited soil microbial activity, which are essential for decomposition. Consequently, cultivation practices such as fertilization have a limited impact on increasing crop yields. Therefore, it is necessary to apply organic fertilizers, such as manure, in sufficient quantities to ensure that plants respond effectively to the technological inputs used by farmers. Cow manure, in particular, enhances soil water retention and mineralizes

organic matter into nutrients that plants can readily absorb (Masruhing et al., 2019).

Fertile soil supports good plant growth and development by providing manure. land becomes proportional because the microorganisms in manure play a role in maintaining soil fertility and health. Soil microorganisms play a role in the decomposition of organic matter, providing nutrients and increasing nutrient absorption by plants, and as biofertilizers and biopesticides, and as environmentally friendly bioremediation (Harefa & Lase, 2024). Appropriately applying manure can increase sweet corn yields. (Pondesta et al. 2023).

Sweet corn yields can be increased by providing adequate manure and by focusing photosynthesis on economically valuable organs, such as corn cobs, through pruning. Pruning aims to control plant growth, both in shape and size, to accelerate and strengthen production, both in quality and quantity. quantity (Herlina & Fitriani, 2017). Leaf pruning can have a major impact on crop yields, depending on the number and age of the leaves pruned, the position of the leaves on the stem, and the plant's growth period. Corn (Satriyo, 2016). Pruning of

\*Correspondence: [sutini.agro@upnjatim.ac.id](mailto:sutini.agro@upnjatim.ac.id)

1) Universitas Pembangunan Nasional "Veteran" Jawa Timur - Jl. Rungkut Madya, Gunung Anyar, Kecamatan Gunung Anyar, Surabaya, Jawa Timur, Indonesia

sweet corn plants is carried out during the generative phase on organs with negative properties, such as the leaves on the top of the cob and the leaves below the cob, as well as the flower organs, which, if not pruned, will inhibit the absorption process. assimilated by the cob during seed filling. Increased plant productivity is greatly influenced by the capacity and balance of source and sink (Matsuda et al., 2011).

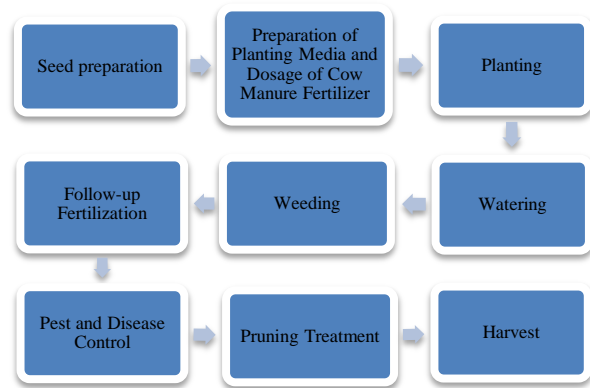
Study Sumajow et al. (2016) stated that pruning three lower leaves on sweet corn plants can increase the circumference of the cob by 17.27 mm, the length of the cob by 21.25 cm, and the weight of the cob by 333.04 grams. Amalia's (2017) research also shows that pruning male flowers after pollination can increase the weight, length, and diameter of the cob. husked, and the cob diameter of sweet corn without husk compared to that without pruning. Unlike the two previous studies, this study not only examined the effect of pruning alone, but also combined various types of pruning (no pruning, leaf pruning, male flower pruning, and leaf and male flower pruning) with the application of cow manure doses (10, 20, and 30 tons/ha). This integrative approach offers novelty by assessing the interaction between organic fertilization and plant canopy management on vegetative growth and generative yield of sweet corn in a more comprehensive manner.

Therefore, this study aims to determine the optimal dose of cow manure and the type of pruning to increase the growth and production of sweet corn.

## 2. Material and Methods

The research was conducted in Sekarputih village, Balongpanggang District, Gresik Regency, with coordinates 7°18'13.39412" South Latitude and 112°26'27.15018" East Longitude, with an altitude of  $\pm 7.1$  meters above sea level, with a temperature of around 28.5 °C and an average humidity of 2,245 mm/year and an average rainfall of 1200–1600 mm/year. The research was conducted from October 2024 to January 2025. The tools used were a sickle, a hoe, a watering can, scissors, sample labels, a vernier caliper, a tape measure, an analytical balance, and a refractometer. The materials used in this study were cow manure, Bonanza F1 sweet corn seeds, and fertilizer: urea, NPK Phonska fertilizer, polybags, soil, and pesticides. The study used a factorial experiment with two factors arranged in a completely randomized design (CRD) repeated three times. The first factor was the cow manure dose, with 3 levels: 10 tons/ha (250 g/polybag), 20 tons/ha (500 g/polybag), and 30 tons/ha (750 g/polybag). The second factor was pruning the lower leaves of sweet corn plants, with 4 levels: without pruning (control), pruning three lower leaves of the cob, pruning male flowers, and pruning three lower leaves of the cob and male flowers. The combination of these two factors yielded 12 treatment combinations, which were repeated 3 times to yield 36

experimental units.



**Figure 1.** Research Flow Diagram

Observation parameters include plant length, number of leaves, stem diameter, weight of husked cob, weight of husked cob, diameter of husked cob, and sweetness level. The observation data were then analyzed statistically with analysis of variance (ANOVA) or F test based on a completely randomized design (CRD) factorial using Microsoft Excel software in 2010. If the F test is significantly different, it is continued with the BNJ (Honestly Significant Difference) test at the 5% level using Microsoft Excel 2010.

## 3. Results and Discussion

### 3.1. Plant Length

The histogram in Figure 1 illustrates the development of sweet corn plant length from 14 to 49 days after planting (DAP) in response to different cow manure treatments. The results show an increase in plant length with age across all treatments, with differences becoming more pronounced at later stages. The 30 tons/ha manure treatment produced the greatest plant length and was significantly greater than the 20 and 10 tons/ha treatments at 49 DAP. The 4.20% increase in plant length observed in the 30 tons/ha treatment indicates that a higher dose of cow manure supports more optimal plant growth, particularly during the generative phase.

The growth of sweet corn plants is greatly influenced by physiological processes, particularly the activity of the apical meristem, which is responsible for cell division and elongation. The availability of nutrients, particularly nitrogen, phosphorus, and potassium, plays a vital role in supporting protein synthesis, cell wall formation, and the transport of photosynthate, thereby influencing plant growth rate. In addition, the increase in plant length is influenced by the ability of leaves to produce photosynthates through efficient photosynthesis. Research by Maharani et al. (2024) also supports the idea that adequate nutrient provision positively impacts plant growth, as photosynthesis and metabolism influence cell growth,

enzyme performance, and plant physiology. Providing the correct dosage of cow manure can support optimal plant

growth (Pondesta et al., 2023).

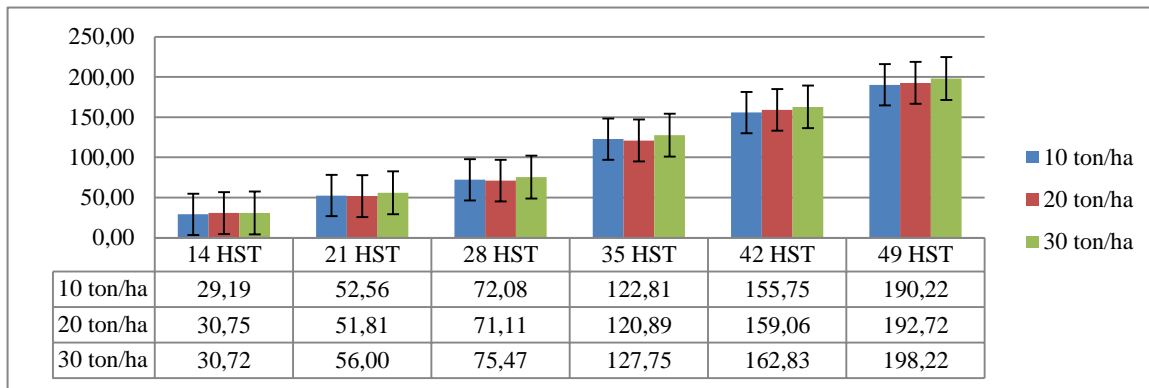


Figure 1 Histogram of Sweet Corn Plant Length

### 3.2. Number of Leaves

The histogram in Figure 2 shows the development of the number of leaves on sweet corn plants from 14 to 49 days after planting (DAP) across the three cow manure doses: 10, 20, and 30 tons/ha. In general, the number of leaves continued to increase with increasing plant age in all treatments. In the histogram of the number of leaves in Figure 2. In the initial phase (14 DAP), the number of leaves remained low and was relatively balanced across treatments. However, from 21 to 49 DAP, the differences

became more apparent. The treatment with 30 tons/ha of cow manure produced the highest number of leaves, significantly different from the 10 and 20 tons/ha treatments. A higher increase in the number of leaves was seen in the treatment of the dose of 30 tons/ha, in the observation of the age of the plant 21 DAP and 28 DAP showed a significant difference, the use of a dose of cow manure of 30 tons/ha showed an increase of 5.83 % (21 DAP) and 4.17% (28 DAP) compared to the dose of manure of 10 tons/ha.

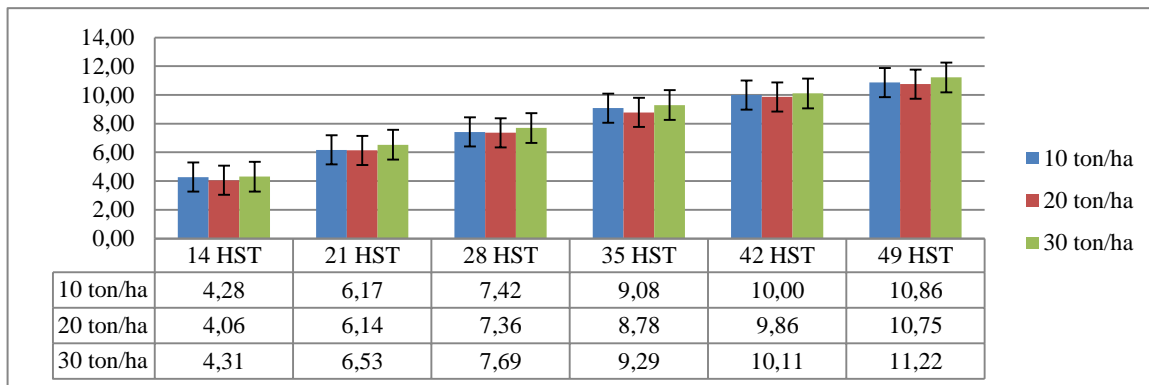


Figure 2 of Leaves in Sweet Corn Plants

Leaf growth in sweet corn plants is an important indicator of the vegetative phase. Leaves act as the primary photosynthetic organs, producing photosynthates to support the growth of both vegetative and generative organs. The activity of the apical meristem greatly influences leaf formation, nutrient availability (especially nitrogen), which is a component of chlorophyll, and cell division and elongation. The more optimal the nutrient supply and photosynthesis, the more leaves the plant forms as it ages.

These results indicate that optimal nutrient availability from manure supports the formation of vegetative tissue, including leaves. Leaves are the main organs of photosynthesis, so their number reflects the plant's capacity to produce energy for growth and yield. Masruhing et al. (2019) stated that manure can increase the number of

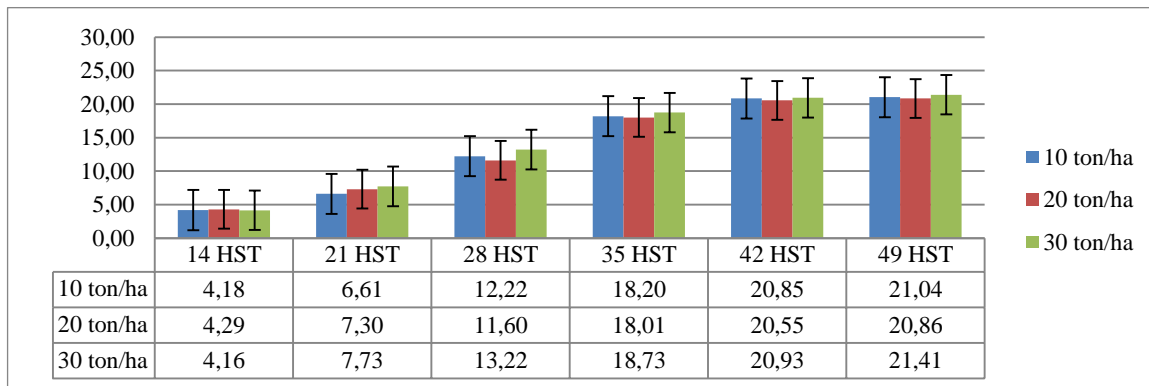
leaves and vegetative growth of plants by improving soil fertility. This finding is also supported by the study by Pondesta et al. (2023), which showed that high doses of cow manure significantly increased the growth components of sweet corn. Thus, a dose of 30 tons/ha of cow manure was the best treatment for increasing leaf number, which, in turn, could positively contribute to plant productivity.

### 3.3. Stem Diameter

The histogram in Figure 3 shows the development of sweet corn stem diameter from 14 to 49 days after planting (DAP) in response to three cow manure doses: 10, 20, and 30 tons/ha. Sweet corn plants are closely linked to physiological activity during the vegetative phase. During this phase, cell division and enlargement occur, stem tissue

thickens, and photosynthate accumulates. Increasing stem diameter strengthens the plant's structure and expands the vascular network to support the distribution of water and nutrients throughout the plant's organs. As the plant ages,

photosynthetic activity increases, leading to greater biomass accumulation, which is reflected in the stem diameter.



**Figure 3** Histogram of Stem Diameter

The histogram results are in Figure 3. In general, the results showed a consistent pattern of increasing stem diameter across all treatments as the plants aged. However, the treatment with a cow manure dose of 30 tons/ha showed higher yields than the other doses. At the age of 14 DAP, there was no significant increase in stem diameter. However, from 21 DAP to 49 DAP, there was a difference: the 30 ton/ha dose treatment showed the highest stem diameter compared to other treatments.

At the age of 49 DAP, the treatment of 30 tons/ha of cow manure gave the highest stem diameter of 21.41 mm. Meanwhile, the S1 treatment reached only 21.04 mm, and the S2 treatment reached only 20.86 mm. At the ages of 21 DAP and 28 DAP, there was an increase in stem diameter by the treatment of 30 tons/ha of cow manure by 16.94 % (21 DAP) and 8.18% (28 DAP), compared to the treatment of 10 tons/ha of cow manure.

Manure provides macronutrients, such as nitrogen and potassium, which contribute significantly to stem cell division and elongation. These results are supported by a study by Eleduma et al. (2020), which found that the application of cow manure significantly increased the stem diameter of corn plants due to increased nutrient availability and more stable soil moisture. The impact of cow manure dosage on its direct effectiveness: Good land and plants. Li et al. (2022) reported that increasing the manure dose to 24 tons/ha significantly increased corn stalk diameter, especially on marginal land with low organic matter content.

### 3.4. Weight Cob Clumped

The results of the analysis of variance for the combination of cow manure and pruning doses on the weight of cob husked plant corn sweet showed no significant interaction; however, in the single treatment, both cow manure and pruning showed a significant effect (Table 1).

**Table 1.** Average Weight Cob Clumped Plant Corn Sweet on the Treatment of Cow Manure Dose and Pruning.

Treatment	Weight of Cob with Husk (g)
<b>Cow Manure Dosage (tons/ha)</b>	
10 tons/ha (S1)	402.96 ± 2.01 a
20 tons/ha (S2)	404.55 ± 2.15 ab
30 tons/ha (S3)	411.03 ± 1.98 b
BNJ 5%	5.46
<b>Pruning</b>	
No Trim (P0)	400.09 ± 2.25 a
Leaf Pruning (P1)	408.98 ± 2.14 bc
Flower Pruning (P2)	403.82 ± 1.97 ab
Prune leaves and flowers (P3)	411.83 ± 2.02 c
BNJ 5%	7.62

Description: The average figures followed by the same letter in the same treatment show no significant difference in the 5% BNJ test.

In Table 1, the single factor of cow manure dose at 30 tons/ha showed the highest results and was significantly different from the other cow manure doses in terms of the weight of cob husked corn sweet. Meanwhile, the lowest yield was found in the treatment with a cow manure dose of 10 tons/ha. These results indicate an increase in the weight of the cob-husked plant corn, with a sweetness of 2.00%, compared to the 10 tons/ha cow manure dose. Cow manure improves the physical properties of soil by reducing bulk density, increasing water content, increasing pore space, and improving the soil's ability to retain water through the process of mineralizing organic matter into nutrients. This result can support optimal plant growth and development by providing 30 tons/ha of cow manure. The availability of nutrients will meet the physiological needs of plants in the generative phase, thus supporting optimal seed formation and filling.

In the treatment of pruning three leaves below the cob and male flowers, it produces the highest-weighted cob

husk and is significantly different from other pruning treatments. There is an increase in the weight of cob husked corn sweetened by the effect of pruning treatment of three leaves below the cob and male flowers by 2.91 % , compared to no pruning. This shows that pruning competing organs, such as leaves below the cob and male flowers after pollination, can prevent photoassimilate competition between *sink organs*. This statement is supported by Mastur (2015), who states that a balance between sources and sinks can increase plant productivity.

Brown and Miller (2021) also found that pruning during the reproductive phase can increase carbohydrate allocation to the cob and result in greater cob weight.

### 3.5. Weight of Corn Without Husk

The results of the analysis of variance showed a significant interaction between the combined effects of cow manure and pruning on the weight of cobs without husks of sweet corn plants.

**Table 2.** Average Weight of Sweet Corn Cobs Without Husks with Cow Manure Dose and Pruning Treatment.

Weight of Corn Without Husk				
Dosage of Cow Manure	Pruning			
	No trim (P0)	Prune leaves (P1)	Flower Pruning (P2)	Pruning Leaves and Flowers (P3)
10 tons/ha (S1)	269.99 ± 3.25 a	274.15 ± 2.89 abc	273.52 ± 3.11 ab	291.21 ± 2.84 c
20 tons/ha (S2)	281.03 ± 2.97 abc	285.33 ± 3.12 bc	282.54 ± 2.85 bc	295.86 ± 3.08 c
30 tons/ha (S3)	288.17 ± 3.41 bc	296.03 ± 3.25 c	294.12 ± 3.06 c	292.61 ± 2.95 c
BNJ 5%	15.12			

Description: The average figures followed by the same letter in the same treatment show no significant difference in the 5% BNJ test.

Table 2 shows that the combination of manure dose treatment of 30 tons/ha and pruning three leaves below the cob produces the best weight of sweet corn cobs without husks and is not significantly different from other treatment combinations, except for the combination of 10 tons/ha of cow manure dose and without pruning, the combination of 10 tons/ha of cow manure and pruning three leaves below the cob and the combination of 10 tons/ha of cow manure dose and pruning of male flowers. There is an increase in the weight of cobs without husks by the combination of 30 tons/ha of manure dose and pruning three leaves below the cob by 9.64 % compared to the combination of 10 tons/ha of cow manure dose and without pruning.

This result demonstrates synergy between applying 30 tons/ha of cow manure and pruning three leaves below the ear. The 30 tons/ha dose of cow manure positively impacts soil fertility and provides the nutrients needed by plants to support optimal ear formation and filling. This finding aligns with Khan et al. (2021) who found that optimal cow manure doses can impact the growth and yield of sweet corn. Meanwhile, leaf pruning plays a role in controlling yield absorption. photosynthesis (assimilate) towards the resultant organs. The three leaves below the cob, specifically at the 3rd, 4th, and 5th nodes, are considered inactive leaves during the generative phase. If these leaves are not pruned, competition between *the source* and *sink* organs will occur . pruning , flow assimilate can more focused on the cob. Pruning the bottom three leaves of the cob has been shown to increase the weight of the husk-free cob of sweet corn plants by maximizing nutrient absorption for cob enlargement. These results are supported by findings from Satriyo (2016), who stated that leaf pruning has a significant effect on sweet corn harvest yields.

### 3.6. Cob Diameter Clumped

Results of analysis of variance for the combination of cow manure and pruning doses on cob diameter of husked plant corn sweet showed no significant interaction; however, in the single treatment, both cow manure and pruning showed a significant effect (Table 3).

**Table 3.** Average Cob Diameter Berkelobot Plants Corn Sweet on Treatment of Cowshed Fertilizer Dose and Trimming.

Treatment	Fluffy Cob Diameter (mm)
<b>Cowshed Fertilizer Dosage (tons/ha)</b>	
10 tons/ha (S1)	51.39 ± 0.62 a
20 tons/ha (S2)	52.25 ± 0.57ab
30 tons/ha (S3)	52.96 ± 0.54 b
BNJ 5%	0.91
<b>Pruning</b>	
Untrimmed (P0)	51.38 ± 0.65 a
Leaf Pruning (P1)	52.64 ± 0.61ab
Flower Pruning (P2)	51.66 ± 0.59ab
Prune leaves and flowers (P3)	53.11 ± 0.58 b
BNJ 5%	1.28

Description: The average figures followed by the same letter in the same treatment show no significant difference in the 5% BNJ test.

Table 3 shows that a cow manure dose of 30 tons/ha yields the highest ear diameter. husked different real with a dose of 20 tons/ha of cow manure, and a dose of 10 tons/ha of cow manure. There was an increase in ear diameter and husked plant corn sweetness by 3.05 % compared to a dose of 10 tons/ha of cow manure. This increase occurred because the greater availability of nutrients, especially NPK, supports optimal ear diameter formation. This result is supported by research by Sunarni et al. (2023), which found that applying 25 tons/ha of cow manure produced a

significantly larger ear diameter than the control and the 10 tons/ha dose.

In the treatment of pruning three leaves below the cob and male flowers, the cob diameter is shown. husked the highest, and significantly different from other pruning. There is an increase in the diameter of the cob husked corn sweetened by the effect of pruning treatment of three leaves below the cob and male flowers by 3.36 %, compared to no pruning. These results indicate that pruning plays an important role in balancing translocation between source and sink tissues, enabling photosynthates to be allocated more optimally from vegetative to generative organs. This result supports the statement by Sumajow et al. (2016) that pruning the lower leaves increases the size and weight of the cob due to the more efficient distribution of photosynthesis.

### 3.7. Sweetness Level

The analysis of variance results showed no interaction between the cow manure and pruning treatments on the sweetness level of sweet corn. However, the single-factor treatment of cow manure and pruning showed a significantly different effect on the sweetness level parameter.

**Table 4.** Average Sweetness Level of Sweet Corn Plants in Cow Manure Dose and Pruning Treatments.

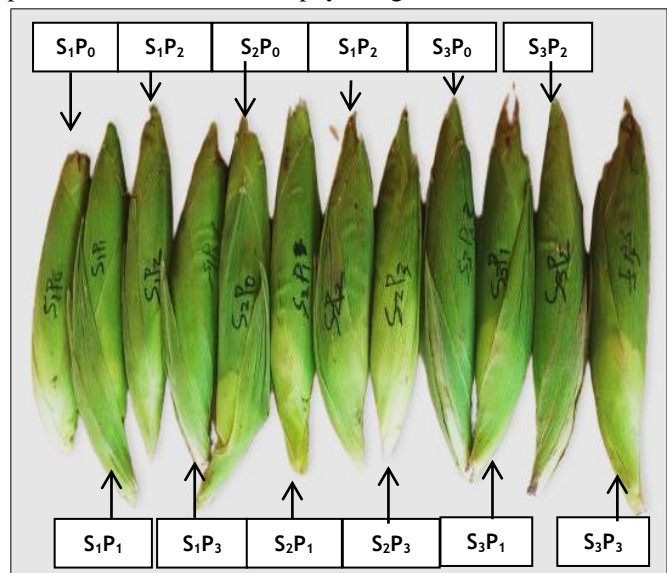
Treatment	Sweetness Level (Brix%)
<b>Cow Manure Dosage (tons/ha)</b>	
10 tons/ha (S1)	11.72 ± 0.45 a
20 tons/ha (S2)	13.17 ± 0.32 ab
30 tons/ha (S3)	13.22 ± 0.28 b
BNJ 5%	0.73
<b>Pruning</b>	
No Trim (P0)	12.63 ± 0.41
Leaf Pruning (P1)	12.37 ± 0.39
Flower Pruning (P2)	12.89 ± 0.36
Prune leaves and flowers (P3)	12.93 ± 0.35
BNJ 5%	Mr.

Description: The average figures followed by the same letter in the same treatment show no significant difference in the 5% BNJ test , tn : No significantly different

Table 4 shows that the single treatment of 30 tons/ha of cow manure had the highest level of sweet corn sweetness and was significantly higher than the 20 and 10 tons/ha cow manure treatments. These results indicate that there is a difference in the level of sweet corn sweetness between the 30 tons/ha cow manure treatment (dose 1.5) and the 10 tons/ha cow manure treatment. These results indicate that, in addition to its role in the vegetative phase, cow manure also improves the quality of sweet corn. Cow manure contains macronutrients (N, P, K) and micronutrients that are released gradually, one of which is

potassium (K), which plays an important role in the transport of photosynthetic sugars to cobs and seeds.

Increasing the dose of cow manure (especially 30 tons/ha) increases the availability of K, leading to greater sugar accumulation in the seeds, reflected in an increase in sweetness (%Brix). Research by Rahman et al. (2024) supports this finding, stating that sugar content in sweet corn is correlated with the availability of macronutrients, especially nitrogen and potassium. This opinion is also supported by Kusparwanti et al. (2022), who stated that potassium plays a role in metabolic processes, nutrient absorption, transpiration, enzyme activity, and starch translocation. This role can increase sugar translocation during starch and protein synthesis, thereby increasing the fruit's sweetness. However, in contrast, the pruning treatment did not show a significant effect on the sweetness level of sweet corn . This is because pruning is more influence distribution photosynthates And size cobs , not on the sugar content of the seeds which is more determined by plant nutrients and internal physiological factors.



**Figure 4** Sweet Corn Harvest Results by Manure and Pruning Treatment

### 4. Conclusion

The results of the study demonstrated that combining cow manure at a dose of 30 tons/ha with pruning three leaves below the cob significantly influenced the weight of the cob without husk. This combination enhances photosynthetic efficiency by directing assimilate distribution more effectively toward ear formation, resulting in more optimal harvest yields. Considering single factors, applying 30 tons/ha of cow manure is optimal for increasing plant height, leaf number, and stem diameter. Its benefits include improving the soil's physical, chemical, and biological properties, leading to more uniform nutrient availability for plants and increased sweet corn yields. Additionally, this treatment improves cob weight with husk,

cob diameter with husk, and sweetness levels, thereby enhancing harvest quality in terms of both size and sweetness preferred by consumers. Pruning three leaves below the cob and removing male flowers most effectively increase cob weight and enlarge the cob, but do not significantly affect the sweetness level of sweet corn.

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