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Morphology of two varieties of sweet corn when applied with cow dung fertilizer

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ABSTRACT

Sweet corn is an agricultural commodity that is very popular with the public because of its many benefits. In Indonesia, sweet corn can be used as a source of food, feed and industrial raw materials. However, the demand for sweet corn in Indonesia is high, resulting in not all needs being met. Efforts that can be made to increase sweet corn production are by using high-yielding varieties and by providing organic fertilizer which can minimize the residue effects caused by inorganic fertilizer. This research aims to determine the effect of two varieties of sweet corn on the growth and production of sweet corn, to determine the correct dose for applying cow dung compost fertilizer on the growth and production of sweet corn and to determine the interaction between two varieties of sweet corn and the dose of cow dung compost fertilizer on the growth and production of sweet corn. This research used a factorial Randomized Block Design (RBD) with 2 factors and 4 replications. The first factor is the use of two varieties of sweet corn, namely V1 (bonanza) and V2 (talenta). The second factor is the application of compost fertilizer at 3 levels, namely: P0 (without organic fertilizer), P1 (600 g/plant hole (equivalent to 12 kg/plot)), P2 (750 g/plant hole (equivalent to 15 kg/plot)). The results of the research showed that the bonanza variety is better in growth which can be seen in the parameters of plant height, number of leaves and leaf area when compared to the talenta variety. Providing cow dung fertilizer can increase plant height, number of leaves and leaf area. A dose of 600 g/plant is the most efficient dose of cow dung fertilizer for the growth of sweet corn plants.

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1. INTRODUCTION

Sweet corn is an agricultural commodity that is very popular with the public because of its many benefits. In Indonesia, sweet corn can be used as a source of food, feed and industrial raw materials (Nelvia *et al*., 2010). Based on national sweet corn production data from January to December 2023 (preliminary figures) it is estimated at 19.56 million tons, a decrease of 2.80 million tons or 12.50% compared to 2022 which was 22.36 million tons (BPS, 2023). Meanwhile, the demand for sweet corn in Indonesia continues to increase, resulting in not all needs being met, so the shortage is met by imported corn.

Efforts that can be made to increase sweet corn production are by using high-yielding varieties and by applying fertilizer, however, continuous use of inorganic fertilizer over a long period of time will have an impact on reducing environmental quality and soil fertility (Yafizham and Lukinawati,

2019). Therefore, the use of organic fertilizer can minimize the residual effects caused by inorganic fertilizer, can add macro and micro nutrients so that it can improve the physical, chemical and biological properties of the soil (Sinuraya and Melati, 2019).

Compost is a type of organic fertilizer that can be used to improve the chemical, physical and biological properties of soil, which ultimately can increase plant growth and yield (da Silva et al., 2014). Sources of organic fertilizer can come from plant remains or animal waste that have undergone a process of decomposition or weathering. One material that is often used as compost is cow dung (Mangardi et al., 2023).

Cow dung compost contains essential macro nutrients such as 0.11% nitrogen, 0.17% phosphorus, 0.04% potassium and complementary micro nutrients such as magnesium, calcium and sulfur. Apart from that, cow dung compost is environmentally friendly, if used in large quantities and cannot damage the soil, it can even help improve the texture, structure and biology of the soil, thereby increasing growth and crop production (Karim *et al*., 2019).

Varieties also play an important role in the growth of corn plants and achieving high productivity is largely determined by the potential yield of the superior varieties planted and is influenced by the interaction between the variety's genetic factors and the management of its growing environmental conditions (Sebayang and Winarto, 2014).

Therefore, the use of superior varieties and the provision of organic fertilizer can increase the growth and production of sweet corn. In addition, the shift from conventional fertilizers to alternative fertilizers derived from waste as fertilizer, presents an opportunity to diversify and revolutionize agricultural practices. This is a prospect that not only offers a practical solution to rising fertilizer costs, but also aligns with the global push towards sustainability and responsible resource management.

2. METHOD

This research was carried out in Ujung Rambung Village, Pantai Cermin District, Serdang Bedagai Regency, North Sumatra, using a land area of 10 x 20 m2 with a height of + 11 meters above sea level (masl) and a coordinate point of 3°35'59.1"N 98°56'43.1 "E. Research begins in February-April 2024.

The materials used in this research were sweet corn seeds of the Bonanza and Talent varieties, compost from cow dung (active ingredients: 1 kg of cow dung, 0.5 kg of rice bran, 0.5 kg of rice husk charcoal, EM4, molasses and water). The tools used are a hoe, measuring tape, sample pack, standard stakes, plastic rope, scales, label paper, camera, sprayer, stationery, calculator, knife, ruler.

This research used a factorial randomized block design (RAK) with 2 factors, namely: the first factor was the use of two varieties of sweet corn plants (V1: bonanza and V2: talenta) and the second factor was the application of cow dung fertilizer with 3 dose levels (P0: without application fertilizer, P1: 600 g/planting hole or equivalent to 12 kg/plot, and P2: 750 g/planting hole or equivalent to 15 kg/plot). The number of plants per bed is 9 plants, the number of samples per bed is 3 samples, the planting distance is 30 x 30 cm and the number of replications is 4. To compare means, the data were subjected to analysis of variance (ANOVA). Duncan's Multiple Range Test was used to identify the mean at a probability level of 5% using Microsoft Excel. Parameters observed were plant height (cm), number of leaves (sheet), leaf area (cm^2) at 3 – 9 week after planting (WAP) with two week intervals.

3. RESULTS AND DISCUSSION

3.1 Plant Height

Based on the results of the ANOVA test, it was found that the treatment of the two sweet corn varieties had a significant effect on the height of plants aged 5, 7, 9 WAP and the treatment of cow dung fertilizer had a significant effect on the height of plants aged 3, 5, 7, 9 WAP. Meanwhile, the interaction between two varieties of sweet corn and cow dung compost had no significant effect on plant height. Of the two sweet corn varieties studied, the bonanza variety had a higher plant height and wider leaf area compared to the talenta variety. This is because genetic factors greatly influence the growth of sweet corn. Sweet corn of various varieties provides diverse growth and production. This is in line with the opinion of Rochana et al. (2016) that plant growth is influenced

by two factors, namely internal factors, which are the inner characteristics of the plant (seed) and environmental factors, namely the external characteristics of the plant.

Providing cow dung compost increased the height of sweet corn plants when compared to the control. Compost from cow dung is rich in nutrients and microorganisms that support plant growth. The nutrient and microbial content in compost improves plant health, improves soil structure and increases water retention, which directly contributes to better plant height, leaf number and leaf area. This is in accordance with research by Khan et al. (2021) which stated that compost treatment from cow dung produced the highest plant height and number of leaves compared to the control. This is suspected because the manure used is already in a mature condition so that the nutrients have undergone mineralization which can be absorbed by the plants. A high dose of cow dung compost causes the availability of nutrients in the soil to become more abundant.

Table 1. Plant Height Against Treatment of Two Sweet Corn Varieties with Cow Manure Compost Fertilizer at 3, 5, 7, 9 week after planting (WAP)

WAP	Sweet corn varieties	Cow dung compost			Mean
		0 g/plants	600 g/plants	750 g/plants	
			……cm……		
3	Bonanza	11,73	12,48	12,83	12,34
	Talenta	11,60	12,30	12,23	12,04
	Mean	11,66a	12,39b	12,53b	12,19
5	Bonanza	54,30	54,23	55,53	54,68b
	Talenta	48,93	49,20	49,48	49,20a
	Mean	51,61a	51,71a	52,50b	51,94
7	Bonanza	105,30	105,28	106,30	105,63b
	Talenta	94,08	99,48	102,48	98,68a
	Mean	99,69a	102,38a	104,39b	102,15
9	Bonanza	161,33	162,08	162,85	162,08b
	Talenta	145,73	146,28	146,40	146,13a
	Mean	153,53a	154,18a	154,63b	154,11

Note: Numbers followed by different letters in different treatment groups are significantly different according to Duncan's Multiple Range Test at the 5% level.

3.2 Number of Leaves

Based on the results of the ANOVA test, it was found that the treatment of providing cow dung compost had a significant effect on the number of leaves aged 3, 5, 7, 9 WAP. Meanwhile, the treatment of two varieties of sweet corn and the interaction between two varieties of sweet corn and cow manure compost had no significant effect on the number of leaves. According to Mpapa (2016), cow dung compost has the ability to provide suitable conditions for plant root penetration, because compost functions to provide nutrients, improve soil macro and micro pores and increase the soil's ability to maintain moisture. Cow manure can increase the soil's ability to store water which will later function to mineralize organic matter into nutrients that can be used directly by plants during their growth period. Karim et al. (2019) stated that cow dung fertilizer is not only able to improve the physical, chemical and biological properties of the soil but also adds macro and micro nutrients to support plants. Furthermore, Garfansa et al. (2022) explained that if vegetative growth is good, the production produced will also increase.

Table 2. Number of Leaves Against Treatment of Two Sweet Corn Varieties with Cow Manure Compost Fertilizer at 3, 5, 7, 9 WAP

WAP	Sweet corn varieties	Cow dung compost			Mean
		0 g/plants	600 g/plants	750 g/plants	
			……sheet……		
3	Bonanza	3,50	4,25	4,75	4,17
	Talenta	3,50	4,25	4,50	4,08
	Mean	3,50a	4,25b	4,63b	4,13
5	Bonanza	6,50	7,25	7,75	7,17
	Talenta	6,25	6,75	7,25	6,75
	Mean	6,38a	7,00a	7,50b	6,96
7	Bonanza	8,00	8,25	9,25	8,50
	Talenta	7,75	8,75	8,50	8,33
	Mean	7,88a	8,50b	8,88b	8,42
9	Bonanza	11,25	12,00	12,50	11,92
	Talenta	11,00	11,75	12,50	11,75
	Mean	11,13a	11,88a	12,50b	11,83

Note: Numbers followed by different letters in different treatment groups are significantly different according to Duncan's Multiple Range Test at the 5% level.

3.3 Leaf Area

Based on the results of the ANOVA test, it was found that the treatment of two varieties of sweet corn and the treatment of cow dung compost had a significant effect on leaf area aged 5, 7, 9 WAP, but had no significant effect on leaf area aged 3 WAP. Meanwhile, the interaction between two varieties of sweet corn and cow dung compost had no significant effect on leaf area. According to research by Budi (2020), the Bonanza corn variety has a higher plant height and wider leaf area. This is because genetically the bonanza variant has a taller morphology and wider leaf area, making the bonanza variant absorb more sunlight so photosynthesis is higher than the talent variant.

According to Dinariani (2014), the essential elements of cow dung compost are able to accelerate leaf growth, increase the area and number of leaves. This causes the photosynthesis process to take place quickly and will directly increase the formation of carbohydrates as food reserves, so that it will affect the total dry weight of the plant and the area index value. Meanwhile, according to Adijaya et al. (2014), the use of cow manure also has an effect on the process of improving the physical properties of the soil by reducing bulk density, increasing water content and total pore space. If cow dung is used as compost, it has the potential to increase soil fertility and create maximum growth and crop yields (Wardana et al. 2021).

Data from analysis of variance showed that the treatment of two varieties of sweet corn and the application of compost from cow dung had no significant effect on all observed variables (plant height, number of leaves and leaf area). This can be caused by other factors that influence the growth of the plant. However, if we look at it as a single factor, the application of cow dung compost and two varieties of sweet corn has a significant effect on the growth of sweet corn. This is supported by research by Syafruddin et al. (2012) that there was no significant interaction between variety treatment and cow dung fertilizer treatment on growth parameters and sweet corn production. It is suspected that differences in the response of sweet corn plants due to the treatment of several varieties do not depend on the application of cow dung fertilizer, and vice versa.

Table 3. Leaf area Against Treatment of Two Sweet Corn Varieties with Cow Manure Compost Fertilizer at 3, 5, 7, 9 WAP

WAP	Sweet corn varieties	Cow dung compost			Mean
		0 g/plants	600 g/plants	750 g/plants	
			….cm^2……		
3	Bonanza	361,15	359,25	362,10	360,83
	Talenta	353,30	358,08	362,43	357,93
	Mean	357,23	358,66	362,26	359,38
5	Bonanza	1618,05	1667,15	1677,28	1654,16b
	Talenta	1594,75	1606,45	1645,88	1615,69a
	Mean	1606,40a	1636,80a	1661,58b	1634,93
7	Bonanza	4564,13	4570,68	4576,93	4570,58b
	Talenta	4477,05	4475,50	4487,10	4479,88a
	Mean	4520,59a	4523,09a	4532,01b	4525,23
9	Bonanza	5648,25	5658,28	5667,75	5658,09b
	Talenta	5475,03	5483,05	5482,25	5480,11a
	Mean	5561,64a	5570,66b	5575,00b	5569,10

Note: Numbers followed by different letters in different treatment groups are significantly different according to Duncan's Multiple Range Test at the 5% level.

4. CONCLUSION

Two varieties of sweet corn had a significant effect on plant height and leaf area at 5, 7, 9 WAP, while there was no significant effect on plant height and leaf area at 3 WAP and number of leaves at 3, 5, 7, 9 WAP. Bonanza is the best variety in terms of sweet corn growth and production compared to Talenta. Cow dung compost had a significant effect on plant height and number of leaves aged 3, 5, 7, 9 WAP and leaf area aged 5, 7, 9 WAP, while it had no significant effect on leaf area aged 3 WAP. The best and more efficient dose of cow dung fertilizer is 600 g/plant. The interaction between two varieties of corn and the application of cow dung compost had no significant effect on plant height, number of leaves, and leaf area.

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