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The Effect of Providing Pearl NPK Fertilizer on the Growth and Production of Sweet Corn (Zea mays saccharata Sturt)

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Abstract: This research was conducted in the experimental garden of the Faculty of Agriculture, Klabat University, from August to December 2018. The research aimed to determine the response to the growth and production of sweet corn due to the application of NPK Mutiara fertilizer and to obtain the correct dose of NPK Mutiara fertilizer for the growth and production of sweet corn. This research used a Randomized Block Design (RAK) with four levels of treatment, namely T0 (without Mutiara NPK fertilizer treatment) as a control, T1 (2 gr/plant), T2 (4 gr/plant), and T3 (6 gr/plant) where each treatment was repeated four times. The research results were that the dose of Mutiara NPK fertilizer did not influence plant height and number of leaves because the growth response of sweet corn was not large enough to have a real influence on plant height and number of sweet corn leaves. The Mutiara NPK dosage influences the flowering age and cob weight because the response of the sweet corn plants is large. The dose of Mutiara NPK fertilizer does not affect plant height and number of leaves but does affect flowering time and ear weight. The best dose of Mutiara NPK fertilizer is 6 gr/plant.

Keywords: Sweet corn; Pearl NPK Fertilizer.

Introduction

Sweet corn (Zea mays saccharata Sturt.) is a horticultural crop that is quite popular and liked by people, especially urban residents because it tastes sweet and sweet corn plays a big role in meeting people's nutritional needs (Novira, Husnayetti, & Yoseva, 2015). Carbohydrates, protein, fat, vitamins A, B, and C, and minerals are all present in sweet corn (Raksun et al., 2021). Even for diabetes sufferers, corn rice is recommended because it is a functional food source that is high in dietary fiber that the body needs, and has a lower glycemic index (GI) than rice (Ishartati et al., 2022). In Indonesia, sweet corn began commercializing in 1980 (Mustadir & Ibrahim (2023). According to Judarwanto (2016), corn is a food plant that benefits human and animal life. Sweet corn, also known as Zea mays Saccaharata sturt, is one food crop that is very popular among people in Indonesia because it tastes sweeter than ordinary corn (Muhammad, Zulfida, & Dewi, 2023). Also, corn is a type of cereal plant, corn has a monocot seed type Arata, (Agustini, & Muharam 2023). Sweet corn production is shorter than regular corn (Rosalyne, 2022). Also, in terms of marketing prospects, it is very supportive (Suranto et al., 2015). One of the factors that influence plant production levels is the availability of nutrients that can be absorbed by plants (Maulana et al., 2015). By comparing land conditions with the conditions needed for farming, it is very important to determine whether the land is suitable for agriculture (Maskumambang et al., (2021). Corn has nutritional content per 100 grams, namely calories 355 cal, protein 9.2 gr, fat 3.9 gr, carbohydrates 73.7 gr, calcium 10 mg, phosphorus 256 mg, iron 2.4 mg, vitamin A 510 SI, vitamin B1 0.38 mg, and water 12 gr, therefore corn is the choice a favorite of corn farmers to make it a profitable superior product.

Market demand for sweet corn continues to increase along with the emergence of supermarkets that require sweet corn in large quantities. Continuously increasing market needs and adequate prices are factors that stimulate farmers to continue developing sweet corn farming businesses. However, demand that continues to increase is not balanced with production

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increases which tend to be unstable and consumer demand fluctuates. Intensification, or the provision of fertilizer, can be used to increase corn production. Sweet corn production in Indonesia in 2011-2015 still fluctuated, namely 17,648,250 tons, 19,387,002 tons, 18,511,853 tons, 19,008,426 tons, and 19,612,435 tons. The average increase in production over the five years was 491,046 tons per year. The harvested areas are 3,864,692 ha, 3,957,595 ha, 3,821,504 ha, 3,837,019 ha, and 3,787,367 ha, respectively. The average decrease in harvested area is 19,331 ha per year (Pusat Data dan Sistem Informasi Pertanian, 2016).

Sweet corn production in North Sulawesi Province in 2011-2015 was 438,504 tons, 440,308 tons, 448,002 tons, 488,362 tons, and 300,490 tons. The average decline in production was 34,503 tons per year. With consecutive harvest areas, namely 119,850 ha, 120,272 ha, 122,237 ha, 127,475 ha, and 80,885 ha. The average decrease in harvested area was 38,965 ha per year. From this data, there was an increase in harvested area from 2011-2014, but there was a reduction in harvested area in 2015 (BPS, 2016).

National household consumption of corn in 2011-2015 was respectively 361,887 tonnes, 438,815 tonnes, 392,985 tonnes, 369,992 tonnes, and 457,244 tonnes, with a growth rate increasing by an average of 1.02% per year. Non-food industry demand in 2011-2014 was respectively 3,670,000 tons, 4,319,000 tons, 4,786,000 tons, and 4,882,000 tons, with a growth rate increasing by an average of 3.33% per year (Ministry of Agriculture, 2016).

Judging from the public's need for corn as a substitute for rice and as an animal feed ingredient which continues to increase in line with developments in food, fertilization technology, and cultivation systems, corn has a large market opportunity (Made, 2010). In efforts to significantly increase production, farmers carry out agricultural intensification, one of which is by using fertilizer. Fertilizer plays an important role in spurring increased productivity in both food crops, horticulture, and plantation crops because they can provide nutrients to plants more quickly with high content (Boer, 2008).

Fertilization generally aims to maintain the balance of nutrients in the soil, reduce the danger of erosion, and increase plant growth and production. The decrease in soil productivity causes a decrease in sweet corn productivity (Mardiana et al., 2023). Corn plants will not produce maximum results if the necessary nutrients are not available. Fertilization can increase crop yields quantitatively and qualitatively (Jumin, 2010). Mutiara NPK fertilizer has the advantage that apart from being quickly absorbed by the soil, the fertilizer can include several elements so that it is more efficient to use compared to a single fertilizer (Hardjowigeno, 2007). The use of Mutiara NPK fertilizer plays a role in the process of plant growth and production. NPK Mutiara contains 16% N (Nitrogen), 16% P2O5 (Phosphate), 16% K2O (Potassium), 0.5% MgO (Magnesium), and 6% CaO (Calcium) which can maintain the balance of macro and micronutrients on the ground. Because of this content, this fertilizer is also known as NPK 16-16-16 fertilizer. NPK compound fertilizer contains macronutrients, namely nitrogen, phosphorus, and potassium. Also, the nutrient elements in Mutiara NPK fertilizer (16: 16: 16) complement each other, the nutrient P plays a role in stimulating root growth and can increase the ability to absorb other nutrients Simorangkir (2023).

The research aims to determine the response of the growth and production of sweet corn to the provision of NPK Mutiara. To get the right dose of Mutiara NPK fertilizer for the growth and production of sweet corn. The advantage of compound NPK fertilizers is that they can be used more efficiently than single fertilizers because one dose can cover various elements (Sanjaya et al., 2016). The benefits of this research are expected to provide information about the growth and production response of sweet corn to the appropriate administration of NPK Pearls for the growth and production of sweet corn and as reference material for future researchers.

Method

This research used a Randomized Group Design (RAK) which consisted of 4 treatment levels and was repeated 4 times. With Mutiara NPK fertilizer treatment, namely (0 gr/plant, 2 gr/plant, 4 gr/plant, 6 gr/plant).

Observation Variables

The variables observed in this study were plant height and number of leaves observed at 5, 7, and 9 WAP and flowering age. Cob weight is measured at harvest.

Data analysis method

The data obtained in this study were analyzed using analysis of variance, and if they were significantly different then continued with the Duncan test. Data processing uses the SPSS version 21.0 program package.

Results and Discussion

Plan Height

The results of the analysis of variance in plant height showed that the application of Mutiara NPK fertilizer did not have a significant effect on plant height. The average plant height treated with different NPK Mutiara doses can be seen in Table 1.

Table 1. Average plant height at Mutiara NPK treatment dose (cm).

Treatment	MST (cm)		
	5	7	9
T0= Control	58.75	140.00	235.12
T1= 2 gr/plant	62.50	157.50	249.37
T2= 4 gr/plant	66.25	160.00	252.62
T3= 6 gr/plant	70.00	165.62	255.62

The results of the Duncan test for plant height aged 5, 7, and 9 WAP showed that the application of Mutiara NPK fertilizer did not have a real effect because the sweet corn plants responded not yet big enough to have a real or different effect. The T3 treatment (6 gr/plant) had a higher plant height than the other treatments, reaching 255.62 cm. This shows that growth is quite good when compared with the description of the height of the Bonanza F1 sweet corn plant (220 – 250 cm), which is thought to be due to genetic and environmental factors. According to Setiawan (1993), the growth, production, and quality of sweet corn are influenced by two factors, namely genetic factors and environmental factors such as soil fertility. The highest average plant height was obtained in the optimum NPK treatment, which shows that sweet corn plants respond to fertilization, especially N nutrients (Sitorus, 2004). Fertilization generally aims to maintain the balance of nutrients in increasing plant growth and production (Jumin, 2010).

This research is different from research by Prakoso & Handayani (2018), where fertilization influences plant height. According to Sutedjo and Kartasapotra (2006), plant height is influenced by the levels of N, P, and K contained in the type of fertilizer as well as the surrounding environmental conditions. Plant height growth can be seen in Table 1. The highest plant at 5 WAP with a dose of 6 gr/plant was 70.00 cm and the lowest was 58.75 cm in the control. The highest plant was at the age of 7 WAP with a dose of 6 gr/plant, namely 165.62 cm and the lowest was in the control, 140.00 cm. The highest plant was at 9 WAP with a dose of 6 gr/plant, namely 255.62 cm and the lowest was in the control, 235.12 cm.

Number of Leaves

The results of the analysis of variance in plant height showed that the application of NPK Mutiara 16:16:16 fertilizer did not have a significant effect on the number of leaves. The average number of leaves of plants treated with different NPK Mutiara 16:16:16 doses can be seen in Table 2.

Table 2. The average number of plant leaves at the Mutiara NPK treatment dose of 16:16:16

Treatment	MST		
	5	7	9
T0= Control	7.37	11.87	16
T1= 2 gr/plant	7.50	12.00	16
T2= 4 gr/plant	7.75	13.00	16
T3= 6 gr/plant	7.87	13.25	16

The results of the Duncan test for the number of leaves aged 5, 7, and 9 WAP showed that the application of Mutiara NPK fertilizer did not have a real effect on the number of leaves because the plant's response was not large enough to the environment, especially N. Gracia, Larry, & Gerrit (2009) stated that To be able to grow well, plants need the nutrients N, P, and K, which are essential nutrients that play a very important role in general plant growth in the vegetative phase. Novizon (2005) stated that the element N is needed in relatively large quantities for every plant growth, especially at the vegetative growth stage, such as increasing the number of leaves. The growth in the number of leaves can be seen in Figure 2. The highest growth in the number of leaves was at the age of 5 WAP with a dose of 6 g/plant, namely 7.87 leaves, and the lowest in the control, namely 7.37 leaves. At the age of 7 WAP with a dose of 6 g/plant, was 13.25 leaves and the lowest in the control was 11.87 leaves. The maximum number of leaves grows at 9 WAP, namely 16 leaves.

Flowering Age

The results of observations and fingerprints of variations in flowering age of plants can be seen in Table 3. The results of the analysis of variations in flowering age show that the application of Mutiara NPK fertilizer has a real influence on flowering age. The average flowering age with different NPK Mutiara treatment doses can be seen in Table 3 and Figure 1.

Table 3. Average flowering age at Mutiara NPK treatment doses

Treatment	Average flowering age (HST)
T0= Control	53.25 b
T1= 2 gr/plant	52.37 ab
T2= 4 gr/plant	51.62 ab
T3= 6 gr/plant	50.75 a

Note: Numbers followed by the same letter in a column are not significantly different.

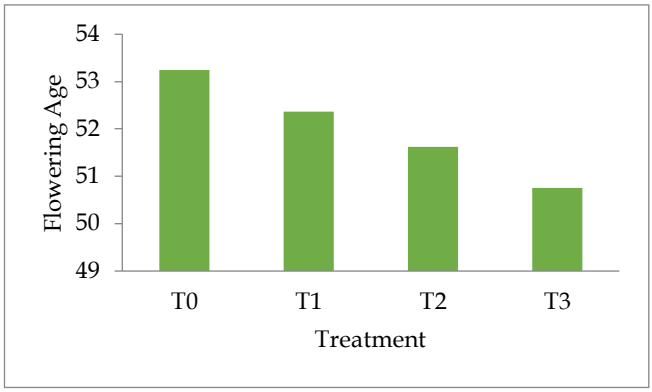

Figure 1. Diagram of Average Age of Flowering

The results of the Duncan test on flowering time showed that the application of Mutiara NPK fertilizer had a real influence on flowering time, this was thought to be due to environmental factors. Apart from fertilizer as an environmental factor, temperature, and altitude are also factors that greatly influence the lifespan of flowers. The lower the terrain of a place, the faster the flower will mature. The flowering age for all treatments was faster than the description of the flowering age for sweet corn varieties Bonanza F1 (55 - 60 days). This shows that environmental factors are more dominant than genetic factors. According to Marsono and Sigit (2004), the available P element can play a role in accelerating the flowering and fertilization process as well as the ripening of seeds and fruit. According to Winarso (2005), the availability of the nutrient N can also increase P uptake, because applying N to soil fertilized with P will dissolve more P so that the nutrient P is more available. Nesia (2014) stated that the vegetative growth rate of plants will soon enter the generative phase which begins with the formation of male flowers.

This research is different from Seipin et al. (2016) research where fertilizer application did not affect plant flowering. Flowering time is influenced by genetic factors and environmental factors such as rainfall, temperature, and humidity. Darjanto & Satifah (1992) stated that the important influence on flower formation is genetic factors in addition to environmental factors such as light, water, and temperature. According to Rukmana (1997), when sweet corn plants enter the flowering phase, environmental conditions with sufficient water are needed. The average flowering age of T1 and T2 was not different from the control, but T3 was different from the control, while T1 and T2 showed no difference from the control and T3. This shows that Mutiara NPK fertilizer at a dose of 6 g/plant has a real influence on the average flowering age.

Cob Weight

The results of the analysis of variations in cob weight showed that the application of Mutiara NPK fertilizer had a real influence on cob weight because the response of the corn plants was large enough to have a real effect. The average weight of cobs treated with different NPK Mutiara doses can be seen in Table 4 and Figure 2

Table 4. Average cob weight at Mutiara NPK treatment dose.

Treatment	Average cob weight (gr)
T0= Control	276.79 a
T1= 2 gr/plant	306.84 a
T2= 4 gr/plant	342.05 ab
T3= 6 gr/plant	401.77 b

Note: Numbers followed by the same letter in a column are not significantly different.

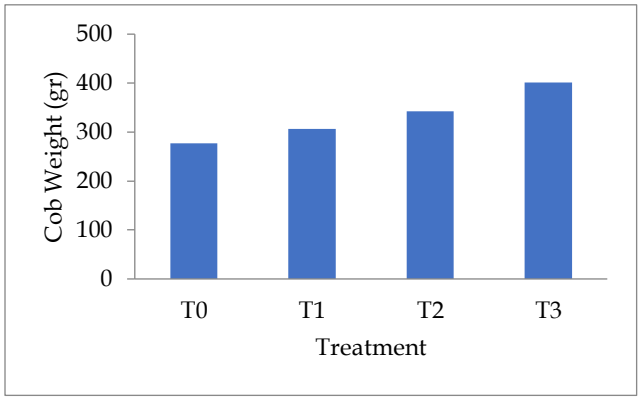

Figure 2. Cob Weight Diagram

Duncan's test results showed that the cob weight of the T3 treatment was different from that of the T1 treatment and control but was not different from that of the T2 treatment, while the T2 treatment was not different from the T1 treatment and the control. This shows that the application of Mutiara NPK fertilizer in the T3 treatment at a dose of 6 g/plant had a significant effect on cob weight. The average weight of cobs in the 6 gr/plant treatment, namely 401.77, has exceeded the description of the weight of sweet corn cobs of the Bonanza F1 variety (300 -400 gr) due to the balanced presence of nitrogen, phosphorus, and potassium in Mutiara NPK fertilizer. Merigo (2006) stated that to form plant tissue, several balanced nutrients are needed so that plant growth occurs optimally, including fruit formation and fruit weight. According to Yunus (2009), the weight of the cob and the number of seeds are influenced by the length of the cob and the diameter of the cob.

The results of this research are the same as research by Wahyudi et al. (2012), where the application of Mutiara NPK fertilizer influenced the weight of the cob. The nutrients nitrogen, phosphorus, and potassium can meet nutrient needs during growth and these nutrients are always needed in every phase of plant growth

because sweet corn is a plant that responds to the nutrients nitrogen, phosphorus, and potassium. Susilowati (2001) states that corn crop yield is determined by the fresh weight of cobs per plant. The higher the cob weight per plant, the higher the yield obtained. Suprapto & Marsuki (2005) stated that apart from fertilizer, the use of superior varieties can increase corn yields and production input efficiency.

Conclusion

Based on research analysis that has been carried out, it shows that the application of Mutiara NPK fertilizer (16:16:16) has no effect on plant height and number of leaves, but does affect flowering age and cob weight. The best dose of Mutiara NPK is 6 gr/plant. If you carry out further research, you should increase the dose to a higher dose.

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All researchers contributed to this research.

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Conflict of Interest
The authors declare no conflict of interest.

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