Journal of Vocational Innovation, Achievement and Education
VOICE Faculty of Vocational Studies, Hasanuddin University

Volume 1, No 2, Agustus – December 2025
Received: 2025-08-18; Accepted: 2025-12-05

The Effect Of Fertilizer Type on The Growth of Mixed variety Maize

Tamara[1,*], **Eka Setiawan**[2,*]

Affiliation: [1,2] Food Crop Production Technology, Hasanuddin University, Makassar
*Correspondence author: tamaraputri2547@gmail.com, eka.setiawan@unhas.ac.id

Abstract

Corn (Zea mays L.) is a strategic food commodity that plays an important role as food, animal feed, and industrial raw materials. In its cultivation, fertilization is an important factor, however, conditions in the field show that agricultural practices still tend to be oriented towards increasing yields without considering sustainability aspects, often causing land degradation and decreasing productivity in the long term. Efforts to increase corn production need to be supported through the application of effective and sustainable fertilization, especially for composite corn. Objective: This study aims to determine the effect of fertilizer types on the growth of composite corn plants of Sukmaraga and Lamuru varieties, including granular organic fertilizer, NPK fertilizer, and a combination of granular organic fertilizer and NPK. Research Method: Using an experimental design with several fertilization treatments, namely without fertilizer (control), granular organic fertilizer, granular organic fertilizer + NPK, and NPK fertilizer. Parameters observed include plant height, number of leaves, stem diameter, and male and female flowering times. Data was analyzed using analysis of variance (ANOVA) and continued with an average comparison to determine differences between treatments. If a significant difference is found, a LSD test is carried out at the 5% level. Results and Discussion: Inorganic fertilizers provide the highest vegetative growth in composite corn, while organic fertilizers play a role in supporting soil fertility and the combination of both has the potential to increase growth while maintaining the sustainability of land productivity.

Keywords: *Composite corn, NPK, Organic granules.*

1. BACKGROUND

The agricultural sector plays a crucial role in supporting national economic development. Agricultural development is directed toward a productive, efficient, and sustainable system through the application of appropriate cultivation technologies, optimal resource management, and the use of effective and environmentally friendly production inputs. One effort to achieve this goal is to increase food crop productivity through the implementation of cultivation systems that are appropriate to crop characteristics and environmental conditions (Cahyaningrum et al., 2024).

Corn (Zea mays L.) is a strategic food commodity that plays a role as a food ingredient, animal feed, and industrial raw material. Increasing corn productivity still faces various obstacles, one of which is the use of varieties suited to environmental conditions. Composite corn is a type of corn that has broad adaptability, making it potential for cultivation on marginal and dry land. According to Sulaiman et al. (2021), fertilizer requirements for composite corn are generally lower than for hybrid corn. Juradi et al. (2021) stated that composite corn is an alternative for farmers because its seeds are more affordable, it is adaptable to various environmental conditions, and it still provides good growth and yields despite using lower cultivation inputs than hybrid corn.

Corn cultivation in the field still faces various challenges, one of which is the fertilization system that is not yet optimal. Fertilization is an important component in cultivation to provide the nutrients needed by plants during the vegetative and generative growth phases. Although inorganic fertilizers are able to provide nutrients quickly and stimulate plant growth, their continuous use without being balanced by organic fertilizers risks reducing soil quality and increasing production costs. On the other hand, although organic fertilizers can improve the physical, chemical, and biological properties of the soil, their nutrient content is relatively low.

Research on fertilization shows that the integrated use of organic and inorganic fertilizers can improve plant growth and yields compared to the use of single fertilizers. Yusworo (2023) reported that combining 2 tons of organic fertilizer per hectare with inorganic fertilizers resulted in higher plant height compared to using either fertilizer alone. A more balanced nutrient supply is thought to be the primary cause of increased plant growth and yield.

Many studies have been conducted on fertilizer use in corn plants, but most studies focus on hybrid corn or sweet corn and only evaluate one type of fertilizer or a specific fertilizer combination. Yusworo's (2023) study examined the effects of organic and inorganic fertilizers on the growth and yield of sweet corn. Juradi et al.'s (2021) study focused more on the adaptability of various composite corn varieties to dryland conditions. Research specifically comparing the effects of fertilizer types—organic fertilizers, combinations of organic and inorganic fertilizers, and inorganic fertilizers—on the growth of composite corn varieties Sukmaraga and Lamuru is still very limited. This situation indicates a research gap that requires further study.

Research on the effect of fertilizer types on the growth of composite corn varieties Sukmaraga and Lamuru is needed to obtain information on the growth effects of organic fertilizers, a combination of organic and inorganic fertilizers, and inorganic fertilizers. The results of this study are expected to provide scientific information on effective and efficient fertilization systems adapted to the preparation of fertilizer recommendations for farmers to support the sustainable increase in composite corn productivity.

2. METHODOLOGY

2.1 Research Sample

This research was conducted from November 2025 to January 2026 in agricultural land of Buae Village, Watang Pulu District, Sidenreng Rappang Regency, South Sulawesi, using a quantitative approach to determine the effect of fertilizer types on the growth of corn plants, with tools in the form of hoes, diggers, meters, digital scales, buckets, markers, stationery, documentation tools, scissors, and spoons, as well as materials in the form of composite corn seeds of Sukmaraga and Lamuru varieties, manure, granular organic fertilizer, NPK 15:10:12 fertilizer, bamboo, nails, and labels; independent variables in the form of types of fertilizers consisting of organic fertilizers, a combination of organic and inorganic fertilizers, and inorganic fertilizers, while the dependent variable in the form of corn plant growth which includes plant height, stem diameter, number of leaves, and age of male and female flowering.

This study used a factorial Randomized Block Design (RAK) with two factors, namely corn varieties (V) consisting of two levels, namely V1: Sukmaraga and V2: Lamuru, and fertilizer type treatment (P) consisting of four levels, namely P0: control (without fertilizer),

P1: organic fertilizer granules 30 g/plant, P2: organic fertilizer 15 g/plant + inorganic fertilizer 6 g/plant, and P3: inorganic fertilizer in the form of NPK fertilizer 12 g/plant. These two factors produced 8 treatment combinations, each repeated 3 times, resulting in 24 experimental units.

2.2 Work Procedure

The research procedure involved several stages, namely land preparation, planting, fertilization, and plant maintenance. Land preparation involved clearing weeds and wood, then cultivating the soil twice using a four-wheeled and two-wheeled tractor. This was followed by the creation of six beds and the application of manure to each bed (Thamrin & Sartia Hama, 2022). Planting was carried out in the loosened soil by making planting holes using a dibbler, then inserting two seeds into each hole with a distance of 40 cm between plants (Thamrin & Sartia Hama, 2022). Fertilization was carried out according to the treatment, namely organic fertilizer, a combination of organic and inorganic fertilizers, and inorganic fertilizer. In the combination treatment, fertilizer was applied through two holes around the plants and was applied at 12 and 31 days after planting. Plant maintenance included replanting, irrigation, weed control, and manual pest and disease control.

2.3 Data Analysis

Primary data were obtained through structured observations of corn plant growth parameters, while secondary data were obtained from relevant journals and books. The parameters observed included plant height (cm), stem diameter (mm), number of leaves (leaflets), and the age of male and female flowering (days). Plant height was measured from the base of the stem to the highest growing point using a meter, while stem diameter was measured using a vernier caliper; both parameters were observed at 22, 35, 42, 49, and 56 days after planting (DAP) (Yulianto, 2025). The number of leaves was calculated based on fully opened leaves at the same observation age (Yulianto, 2025), while the age of male and female flowering was calculated based on the number of days from planting until the male and female flowers appeared completely (Muhamad Farhan et al., 2025). The observation data were analyzed using analysis of variance (ANOVA) with Microsoft Excel to determine the effect of treatment on each parameter, and if there was a significant difference, it was continued with the Least Significant Difference (LSD) test at a significance level of 5%.

3. RESULTS AND DISCUSSION

3.1 Research Results

3.1.1 Plant Height

The results of the analysis of variance (Appendix 5) show that the treatment of fertilizer types on corn varieties Sukmaraga and Lamuru had a significant effect on the parameters of plant height at 22 hst, 35 hst, 42 hst, 49 hst, 56 hst, but not on the Lamuru variety at 56 hst which is presented in Table 1.

Table 1. Results of the height parameters of sukmaraga and lamuru plants 22 hst, 35 hst, 42 hst, 49 hst, 56 hst

Variety	Parameter High Plant	Treatment				E.G. BNT 0.05%
		P0	P1	P2	P3	
Sukmaraga	22 Hst	9a	14.3b	12ab	15b	2.15
	35 Hst	32x	54yz	43xy	62.3z	
	42Hst	48.3a	77.8b	58.3a	111.6c	
	49 Hst	70x	110.3y	98.1xy	157.6z	
	56 Hst	124a	154.5ab	149a	197.5b	
NP. BNT 0.05%			2.15			
Lamuru	22 Hst	15b	6a	11a	8,33a	2.15
	35 Hst	60z	20x	40.33y	32,33xy	
	42Hst	85b	27.73a	65,17b	47.83a	
	49 Hst	131.67y	47x	97.5y	56,83x	
	56Hst	178.67	98.33	157.17	116.17	≠ significantly different
NP. BNT 0.05%			2.15			

Description: Numbers followed by the same letter are not significantly different in the 0.05% BNT follow-up test.

The changes in the height of the Sukmaraga variety of corn plants can be seen in Figure 1:

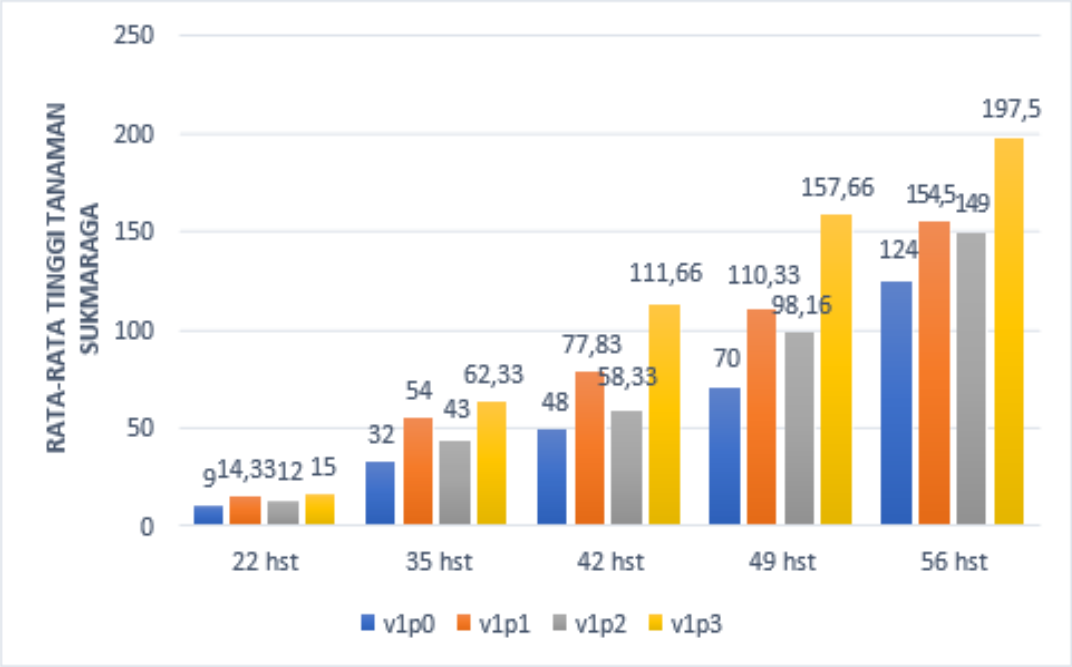

Figure 1. Average height of Sukmaraga variety corn plants

The changes in the height of the Lamuru variety of corn plants can be seen in Figure 2:

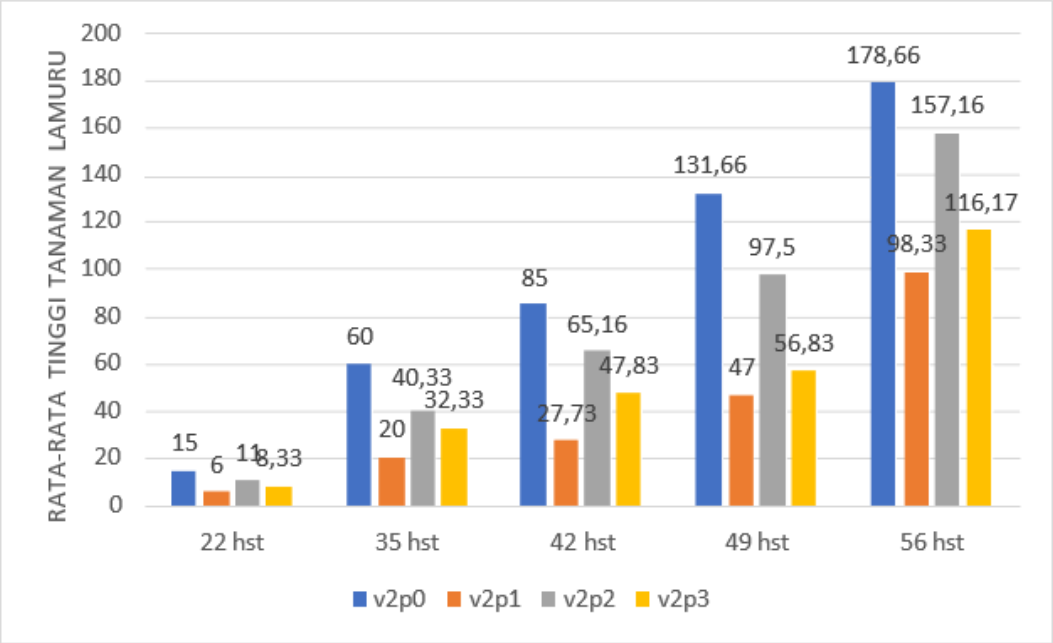

Figure 2. Average height of Lamuru variety corn plants

3.1.2 Stem Diameter

The results of the analysis of variance show that the treatment of fertilizer types on the Sukmaraga variety of corn has a significant effect on the stem diameter parameter at 49 hst, the Lamuru variety has a significant effect on the bar diagram parameters at 22 hst, 35 hst, 49 hst which are presented in Table 2.

Table 2. Sukamarga and lamuru stem diameter parameters

Variety	Parameter Diameter Young	Treatment				E.G. BNT 0.05%
		P0	P1	P2	P3	
Sukmaraga	49 Hst	18a	20,33a	18,33a	23,83b	2,15
NP. BNT 0.05%				2,15		
Lamuru	22hst	16,67c	7a	12.33b	9ab	2,15
	35 hst	28.33x	16.67x	25x	21.33x	
	49 hst	25,5b	15.83a	18,83a	18,83a	
NP. BNT 0.05%				2,15		

Description: Numbers followed by the same letter are not significantly different in the 0.05% BNT follow-up test.

The changes in the diameter of the Sukmaraga corn stalks can be seen in Figure 3:

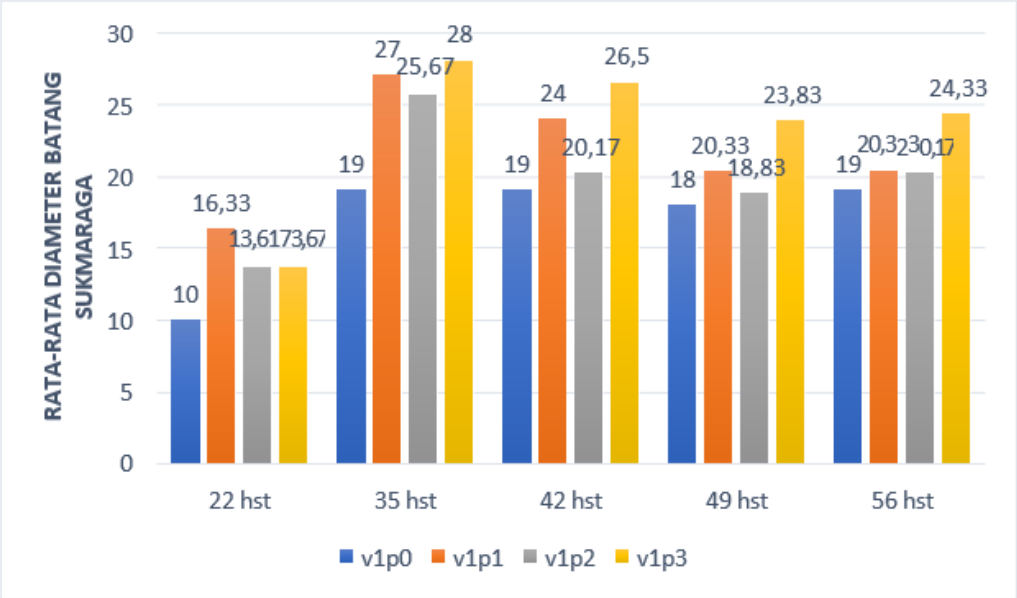

Figure 3. Average stem diameter of Sukmaraga variety corn plants

The changes in the diameter of the Lamuru variety of corn stalks can be seen in Figure 4:

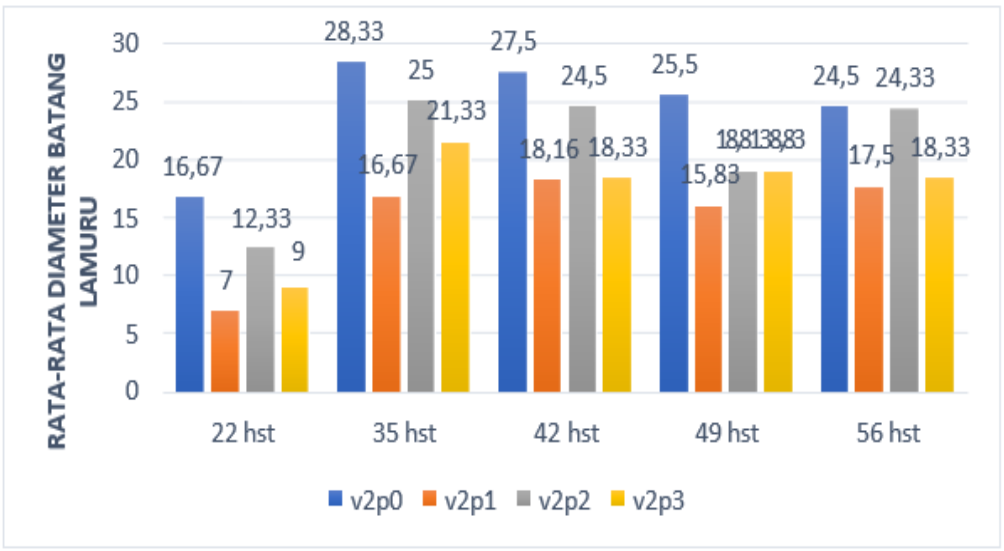

Figure 4. Average stem diameter of Lamuru variety corn plants

3.1.3 Number of Leaves

The results of the analysis of variance show that the treatment of fertilizer types on the Sukmaraga variety of corn had a significant effect on the number of leaves at 22 hst, 35 hst, 42 hst, 49 hst, 56 hst, the Lamuru variety had a significant effect on the number of leaves at 22 hst, 49 hst as presented in Table 4.

Table 4. Number of leaves of Sukmaraga and Lamuru, presented in the table below.

Variety	Parameter Number of Leaves	Treatment P0	P1	P2	P3	E.G. BNT 0.05%
Sukmaraga	22 Hst	5a	6,33	6ab	6.67b	2,15
	35 Hst	7x	9.67y	8,33xy	9.33y	
	42Hst	7a	9b	8,5b	9b	
	49 Hst	9x	9,83xy	9x	11.83z	
	56 Hst	10a	12.33b	12,17b	13,5b	
NP. BNT 0.05%			2,15			
Lamuru	22 Hst	6a	3.67a	6.33a	5a	2,15
	49 Hst	11,83y	7,17x	10,17xy	8.5x	
NP. BNT 0.05%			2,15			

Description: Numbers followed by the same letter are not significantly different in the 0.05% BNT follow-up test.

The change in the number of leaves of the Sukmaraga variety of corn can be seen in Figure 5:

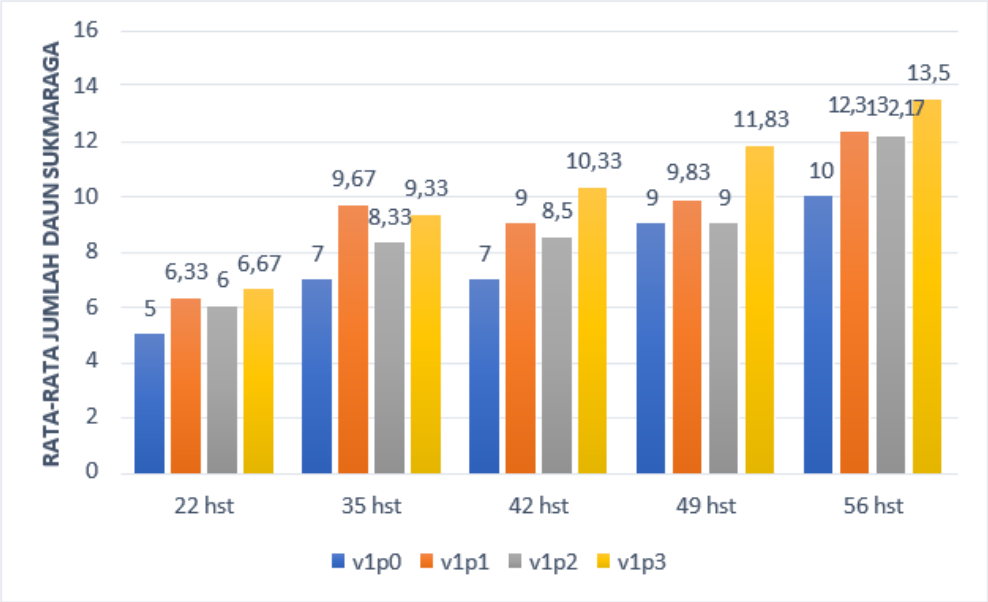

Figure 5. Average number of leaves of Sukmaraga variety corn plants

The change in the number of leaves of the Lamuru variety of corn can be seen in Figure 6:

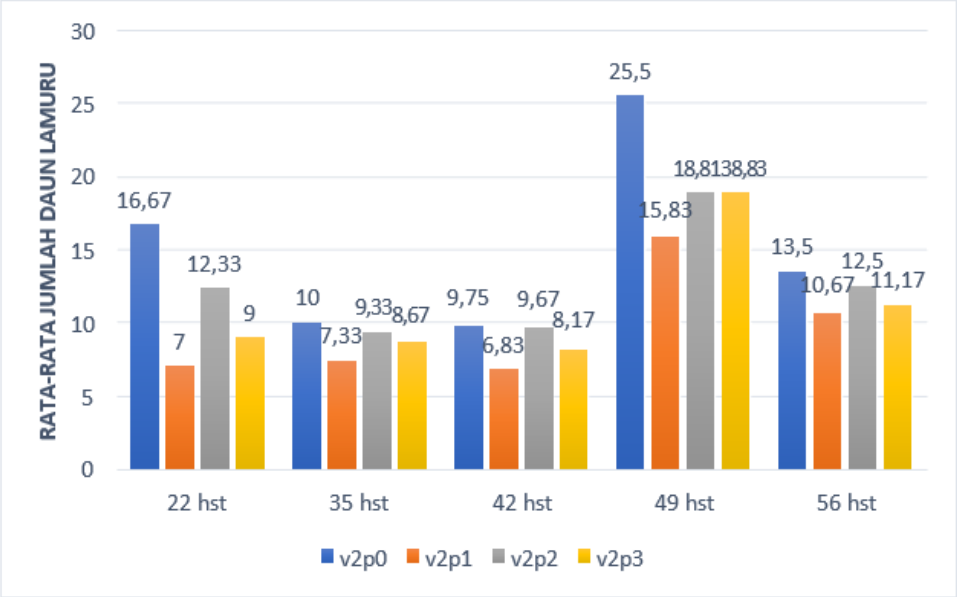

Figure 6. Average number of leaves of Lamuru variety corn plants

3.1.4 Flowering Time

The average flowering time results for the Sukmaraga and Lamuru varieties are presented in bar charts 7 and 8 below:

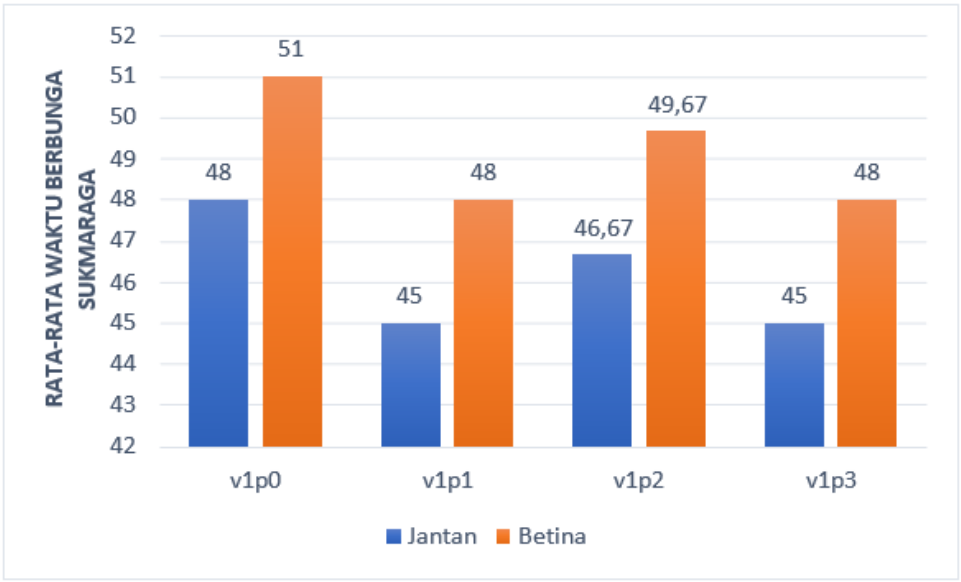

Figure 7. Average flowering time of Sukmaraga variety corn plants

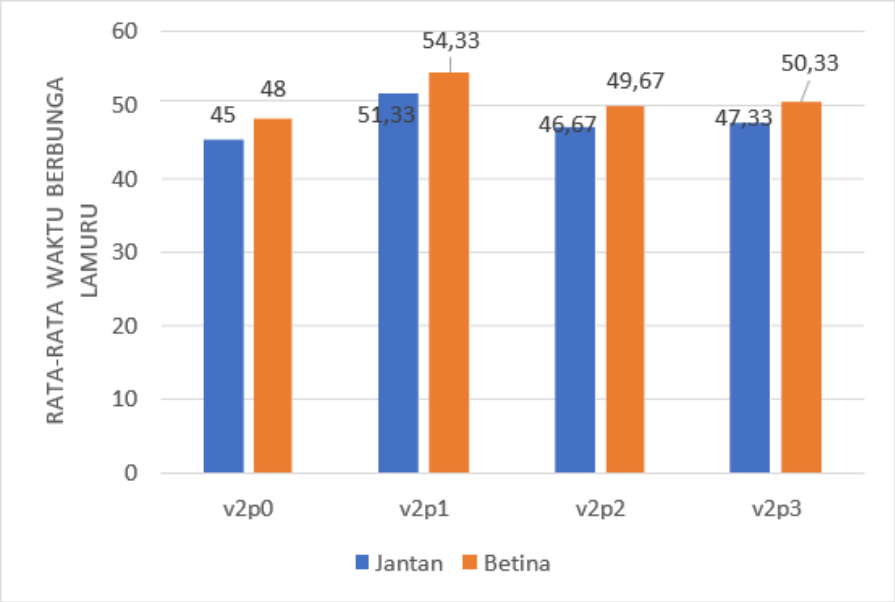

Figure 8. Average flowering time of Lamuru variety corn plants

3.2 Discussion

3.1.1 Effect of Fertilizer Type on Composite Corn Plant Growth.

The results of the analysis of variance on the average plant height, stem diameter, number of leaves and flowering time of the composite corn variety Sukmaraga at the age of 22 days after planting, 35 days after planting, 42 days after planting, 49 days after planting, and 56 days after planting. Shows that the highest increase in the height of the composite corn variety Sukmaraga until the age of 56 days after planting is in the treatment p3, namely inorganic fertilizer. This shows that inorganic fertilizer is able to provide nutrients, especially nitrogen, in a form that has been absorbed by plants so that it supports vegetative growth, this result is in line with Yusworo et al. (2023) who stated that inorganic fertilization according to plant needs can increase the vegetative growth of corn by providing nutrients that are available quickly. In the Lamuru variety, the highest average plant height was achieved in the control treatment (P0). This is likely due to the availability of initial soil nutrients that are sufficient for the vegetative phase of the plant, so that the addition of fertilizer does not result in better plant growth. This condition shows that the effectiveness of fertilization depends on soil fertility and variety characteristics. Therefore, fertilization should be tailored to plant needs to ensure more efficient nutrient utilization. This is in line with Kusumawati (2021), who stated that if levels exceed tolerable limits, certain plants will exhibit signs of abnormal growth. These abnormal characteristics appear as symptoms of nutrient toxicity, and crop yields will decline significantly.

The stem diameter of the sukmaraga variety in the last observation had the highest value in the inorganic fertilization treatment (p3), while in the lamuru variety the highest value of corn was not given treatment (p0) The number of leaves of the sukmaraga variety in the last observation had the highest value in the inorganic fertilization treatment (p3), while in the lamuru variety the highest value of corn was not given treatment (p0). Flowering time of the

sukmaraga and lamuru varieties in the last observation showed a fast flowering day in the treatment (p3). Plant height, number of leaves, and stem thickness are greatly influenced by the availability of nitrogen (N), phosphorus (P), and potassium (K) nutrients. Nitrogen helps make chlorophyll and proteins that support cell division and growth, thereby increasing plant vegetative growth. Phosphorus helps root growth and accelerates energy metabolism,

Meanwhile, potassium plays a role in enzyme activity, driving photosynthesis, and strengthening plant tissues. Adequate nutrient availability helps photosynthesis work better, resulting in better plant growth. These results align with research by Mulyati et al. (2021), which states that the application of organic and inorganic fertilizers can increase the availability and uptake of N, P, and K, ultimately affecting corn growth. The difference in growth of the two varieties shows that the effectiveness of fertilization is not only determined by the type of fertilizer used, but also by the ability of the variety to absorb and use the nutrients available in the soil.

3.2.2 The Effect of Granular Organic Fertilizer on the Growth of Composite Corn Plants

Granular organic fertilizer (P1) treatment improved several growth parameters compared to no fertilization, although results fell short of those achieved with combination or inorganic fertilizer treatments in some parameters. This is because granular organic fertilizer works gradually, releasing its elements slowly as organic matter decomposes in the soil. Organic fertilizers provide essential nutrients and improve the physical, chemical, and biological properties of the soil. Their natural ingredients can increase cation exchange capacity, improve soil structure, and encourage the activity of soil microorganisms. These improvements result in better root development, thereby increasing the efficiency of nutrient uptake by plants. Mulyati et al. (2021) explain that organic fertilizers can increase nutrient availability, improve soil quality, and enhance the activity of microorganisms that play a role in providing nutrients to plants. The results of this study are also supported by Munawir et al. (2023), who reported that the application of organic fertilizer significantly affected plant height and leaf number in corn because it improved soil quality, making nutrients more readily available to plants. Therefore, the use of granular organic fertilizer can be an alternative to increase plant growth while maintaining soil fertility sustainably.

3.2.3 The Effect of a Combination of Organic and Inorganic Fertilizers on the Growth of Composite Corn Plants

The research results showed that the combination of organic and inorganic fertilizers (P2) resulted in relatively good growth across several observed parameters. The simultaneous use of both types of fertilizers allows for rapid nutrient supply through the inorganic fertilizer while simultaneously improving soil conditions through the organic fertilizer.

Inorganic fertilizers provide readily available N, P, and K nutrients to plants, while organic fertilizers increase the efficiency with which plants utilize these nutrients by improving the soil's structure and ability to retain nutrients. The combination of these two fertilizers helps plants absorb nutrients more effectively, thus supporting leaf growth, stem elongation, and root

system development. According to Yusworo (2023), using a mixture of organic and inorganic fertilizers typically yields better results for most corn growth and yield parameters than using only one type of fertilizer.

3.2.4 The Effect of Inorganic Fertilizer on the Growth of Composite Corn Plants

The use of inorganic fertilizer (P3) resulted in the best results for various growth parameters of the sukmaraga variety, particularly plant height, leaf number, and stem thickness. This indicates that the nutrients from chemical fertilizers are quickly absorbed by the plants to support their growth. Inorganic fertilizers contain key macronutrients such as nitrogen, phosphorus, and potassium in a soluble form so that plant roots can absorb them quickly. Nitrogen is a constituent of amino acids, proteins, chlorophyll, nucleic acids, and coenzymes, which enhances the plant's ability to photosynthesize and grow better. Phosphorus, a constituent of many proteins, phospholipids, coenzymes, nucleic acids, and metabolic substrates, is important in energy transfer, while potassium is involved in photosynthesis, carbohydrate translocation, and protein synthesis. The results of this study are in line with Dolsenyawi et al. (2026) who found that the use of Phonska fertilizer can increase plant height, number of leaves, stem diameter, and sweet corn yield because it provides complete and easily available N, P, and K nutrients for plants.

4. CONCLUSION AND SUGGESTIONS

Based on the research results, the type of fertilizer affects the growth of composite corn plants, especially on plant height, several parameters of stem diameter, and number of leaves. Granular organic fertilizer is able to support plant growth, although its effect is not better than NPK fertilizer, while the combination of granular organic fertilizer and NPK provides quite good growth through the provision of more balanced nutrients. NPK fertilizer showed the best results on vegetative growth, especially on the Sukmaraga variety. Further research is recommended to use more diverse observation parameters, conduct further research to determine the optimal type and dosage of fertilizer for the Lamuru variety, and conduct laboratory soil analysis to determine the condition and availability of nutrients more accurately.

5. REFERENCE

Agustine, L., Ramadhan, R. A. M., Andri, A., & Manurung, R. (2022). The Effect of Organic, Inorganic, and Mixed Fertilizer Application on Plant Height and Leaf Number in Corn (Zea mays L.). Jurnal Technopreneur (JTech), 10(2), 1–4. https://doi.org/10.30869/jtech.v10i2.953

Anam, K., Hiola, M. S., Taufik, N., Indrayana, K., Muhtar, & Yusuf, M. (2023). Production of Free Pollinating Corn Seed Sources (Composite) (M. P. Sirappa, Ed.).

Balitbangtan. (2021). Reference recommendations for location-specific N, P, and K fertilizers for rice, corn, and soybean crops in paddy fields (per sub-district): Book I: Rice (Firman Fer).

Bertham, Y. H., M, B. G., & Utami, K. (2022). Increasing Public Knowledge in Providing Organic and Inorganic Fertilizers for Productivity Plant. 6(4), 2961–2972. https://doi.org/10.31764/jmm.v6i4.9322

Cahyaningrum, H., Sembiring, J., & Suanda, I. W. (2024). Sustainable Agricultural Systems. GET PRESS INDONESIA.

Dolsenyawi, F., Polnaya, F., & Lawalata, I. J. (2026). Response of Phonska Fertilizer Application to the Growth and Production of Sweet Corn (Zea mays Saccharata Sturt). 2(10). https://doi.org/10.69840/marsegu/2.10.2026.707-722

Fiqriansyah, M., Putri, S. A., Syam, R., Rahmadani, A. S., Frianie, T. N. S. A.

R. ., N, Y. I. S., Adhayani, A. N., Fauzan, N., Bachok, N. A., Manggabarani, A. M., & D, Y. (2021). Cultivation Technology of Maize (Zea mays) and Sorghum (Sorghum bicolor (L.) Moench) Crops. UNM FMIPA Department of Biology

Juradi, M. A., Heni, S. P., Suwitra, I. K., Fahmi, F. N., Negara, A., Ardjanhar, A., & Abid, M. (2021). Adaptation test of various dry-land composite corn varieties in Sigi regency, Central Sulawesi. IOP Conference Series: Earth and Environmental Science, 759(1), 012035.
https://doi.org/10.1088/1755-1315/759/1/012035

Kusumawati, A. (2021). Soil Fertility and Fertilization (p. 75). Poltek LPP Press.

Muhamad Farhan, Muhammad Syafi'i, & Kasdi Pirngadi. (2025). Synchronization Test (Nicking Period) of Male and Female Flower Pollination Time in the MS UNSIKA Sweet Corn Line on Yield and Yield Components. Agriprima: Journal of Applied Agricultural Sciences, 9(1), 61–73. https://doi.org/10.25047/agriprima.v9i1.695

Mulyati, M., AB, B., & Tejo Wulan, R. S. (2021). Nutrient Uptake of N, P, and K and Corn Plant Growth at Various Doses of Inorganic and Organic Fertilizers in Inceptisol Soil. Journal of Science, Technology & Environment, 55–66. https://doi.org/10.29303 https://doi.org/10.29303/jstl.v0i0.245

Saputro, W. A., Budiyoko, Susilo, E., Rato, Y. Y. Da, Anwar, M. F., Wibowo, A., Muala, B., Adriani, D., Suciati, L. P., Setyarini, A., & Sulistyowat, L. (2024). SUSTAINABLE AGRICULTURAL DEVELOPMENT (Vol. 2).

Sleman, K., Regency, S., Tustiyani, I., Daud, R. J., Rifkiananto, N., Pertanian, F., Tidar, U., Pertanian, P., Magelang, Y., Korespondensi, P., Sleman, K., & Istimewa, D. (2025). Study of NPK Fertilization on Sweet Corn Plants in Prambanan District, Sleman Regency Study. 8(September), 523–531. https://doi.org/10.55043/agroteknika.v8i3.419.

Sulaiman, A. A., Djufry, F., Bahrun, A. H., & Nur, A. (2024). Standardized Corn Cultivation.

Sulaiman, A. A., Kariyasa, I. K., Hoerudin, Subagyono, K., & Bahar, F. A. (2018). QUICK WAY TO ACHIEVE CORN SELF-SUFFICIENCY (Vol. 2).

Syam, S. B., Technology, P., Agriculture, H., Muhammadiyah, U., Rappang, S., Betao, D., District, R., & Riawa, P. (2022). 666-Article Text-2984-1-10-20220826 (1). Journal of Agricultural Science and Technology, 2 No.1, 9–14.

Thamrin, N. T., & Sartia Hama. (2022). The Effect of Chicken Manure on the Vegetative Growth of Corn (Zea mays L.) Plants. INSOLOGY: Journal Science And Technology, 1(4), 7. https://doi.org/10.55123/insologi.v1i4.829

Wadi, H., Edy, E., & HS, S. (2024). The Effect of Various Types and Doses of NPK Fertilizer on the Growth and Production of Sweet Corn (Zea mays saccharata STURT L.). AGrotekMAS Jurnal Indonesia: Jurnal Ilmu Peranian, 5(2), 179–187. https://doi.org/10.33096/agrotekmas.v5i2.608

Widianingsih Merlina Mery, Nicken Octavia Suparno, Vania Azalia, Zilvina.B, & Fatmawati. (2025). The Effect of Organic Fertilizer Use on Soil Properties and Biology. Journal of Psychosocial and Education, 1(2), 1104–1110. https://publisherqu.com/index.php/psikosospen/article/view/2712

Yulianto, R. D. (2025). The Effect of Fertilizer Type on Vegetative Growth of Hybrid Corn (Zea mays L.). Agroplant Journal, 8(1), 54–64. https://doi.org/10.56013/agr.v8i1.3141

Yusworo Eddy. (2022). The Effect of Organic and Inorganic Fertilizers on the Growth and Yield of Sweet Corn (Zea mays sacharata). Journal of Agricultural Sciences, 25(1), 770–778.