

---

## Effectiveness of Compost and NPK Application on Tomato Plant Growth and Yield (*Solanum lycopersicum* L)

M. Azizi<sup>1\*</sup>

<sup>1</sup> Agroteknologi, Universitas Papua, Indonesia

\*Corresponding author. Email: (m.azizi@unipa.ac.id)

---

### Article info :

Article History:

Received: April 3, 2026

Revision: April 22, 2026

Accepted: April 27, 2026

Online Publication: April 30, 2026

### Abstract

Tomatoes are a high value horticultural crop widely used as fresh produce and in the food processing industry. Increasing tomato production requires appropriate cultivation techniques, particularly in the management of effective and sustainable fertilization. The use of compost as an organic fertilizer plays a role in improving soil properties, while inorganic fertilizers such as NPK provide nutrients quickly. However, the effectiveness of various doses of compost and NPK fertilizer, as well as their interaction on the growth and yield of tomato plants, still needs to be studied. This study aims to determine the effects of compost and NPK fertilizer doses and their interaction on the growth and yield of tomato plants. The study was conducted at the Faculty of Agriculture, University of Papua, Manokwari, from January to March 2026 using a completely randomized block design with a two factor factorial pattern. The first factor was compost dose (Control, 10 tons/ha, 20 tons/ha), and the second factor was NPK fertilizer rate (Control, 100 kg/ha, 200 kg/ha), with 9 treatment combinations and 3 replicates (27 experimental units). Data were analyzed using ANOVA and the BNJ test at the 5% level. The results showed that compost had no significant effect on any of the variables. Conversely, NPK fertilizer had a significant effect on fruit diameter, number of fruits, and fruit weight per plant, but not on plant height and number of leaves.

Keywords:

Tomato, Compost, NPK Fertilizer, Plant Growth, Yield

---

### 1. Introduction

Tomatoes are a versatile horticultural crop that are not only consumed as fresh produce but are also used in the pharmaceutical, cosmetic, and food processing industries [1]. In addition, tomatoes contain various vitamins and minerals that play an important role in maintaining health and preventing disease [2]. As market demand increases, tomato cultivation continues to expand, yet it still faces various challenges, particularly regarding soil fertility management [3].

The intensive and sustained use of inorganic fertilizers over several decades has led to negative impacts, such as a decline in soil organic matter content, soil structure degradation, and reduced soil microorganism activity [4]. These conditions have the potential to reduce crop productivity in the long term. Therefore, more sustainable nutrient management alternatives are

needed, one of which is through the use of organic fertilizers such as compost combined with inorganic fertilizers (NPK).

The use of organic fertilizer is a promising solution; it contains multiple nutrients that benefit both the soil and plants. In slightly acidic soils, it can serve as a strategic approach to address various challenges, enhance soil fertility, reduce aluminum and manganese toxicity, boost soil microorganism activity, and improve overall soil structure, thereby supporting optimal plant growth and, ultimately, increasing crop yields [5].

Tomato plants require relatively large amounts of the nutrients N, P, and K. Nitrogen plays a crucial role in protein production, leaf growth, and metabolic processes such as photosynthesis. Phosphorus, on the other hand, stimulates root growth and the development of a healthy root system in young plants, and serves as a component of cell nuclei (nucleic acids), fats, and proteins [6]. Potassium aids in the formation of proteins and carbohydrates, enhances the plant's resistance to pests and diseases, and improves crop quality [7].

Based on the background described above, a study is needed on "Effectiveness of compost and NPK Application on Tomato Plant Growth and Yield (*Solanum Lycopersicum* L ) The effect of different combinations of compost and NPK fertilizer doses on the growth and yield of tomato plants (*Solanum lycopersicum*) of the Gustavi F1 variety"

## 2. Material and Methods

This study was conducted at the Faculty of Agriculture, University of Papua, West Manokwari District, Manokwari Regency, West Papua. Agroclimatology and Agronomy Laboratory, University of Papua. The study was carried out from January 2026 to March 2026.

The tools used in this study were seedling plastic bags, hoes, a tractor, a soil sieve, a watering can, marker stakes, writing utensils, a measuring tape, a camera, a knife, an analytical balance, scissors, sacks, and plastic clips. The materials used were Gustavi F1 variety seeds, compost fertilizer, plastic twine, polybags, compost, and NPK fertilizer.

This study employed a randomized block design (RBD) with a factorial layout consisting of two factors. The first factor was compost application rate (C), which had three levels: C0 (no compost), C1 (10 tons/ha or equivalent to 2.8 kg/plot), and C2 (20 tons/ha or equivalent to 5.6 kg/plot). The second factor was the NPK fertilizer dose (N), which consisted of three levels: N0 (no NPK), N1 (100 kg/ha or equivalent to 4 g/plot), and N2 (200 kg/ha or equivalent to 8 g/plot). This study used a factorial randomized block design (RBD) consisting of 9 treatment combinations, each treatment with 3 replicates, resulting in a total of 27 experimental units.

The growing medium used in this study was topsoil, with general characteristics including a medium soil texture, a neutral to slightly acidic pH, and a low to moderate organic matter content. The compost used was derived from organic matter that had undergone complete decomposition, characterized by a dark color, no odor, and a relatively stable C/N ratio, as well as containing macronutrients such as nitrogen (N), phosphorus (P), and potassium (K). Organic fertilizer is applied at planting by mixing it into the growing medium according to the predetermined treatment dose. Meanwhile, NPK fertilizer is applied one week (7 days) after planting by burying it around the plant at a distance of 2–5 cm from the main stem and a depth of  $\pm 5$  cm.

### 3. Results and Discussion

#### 3.1 The Effect of Organic Fertilizer Application on the Growth and Yield of Tomato Plants

##### 3.1.1 Plant Height (cm)

Observation data on tomato plant height at 30 and 45 days after planting following the application of organic fertilizer indicate that there was no significant effect on tomato plant height, as shown in Table 1.

Table 1. Average height of tomato plants at 30 and 45 days after planting following the application of organic fertilizer.

Compost treatment ha <sup>-1</sup>	Plant Height (cm)	
	30 days after transplanting	45 days after transplanting
Kontrol	57.26	88.45
10 ton/ha	58.93	88.11
20 ton/ha	58.67	89.53

Table 1 shows that plant height resulting from the application of organic fertilizer did not show significant differences across all treatments tested at 30 and 45 days after transplanting. It is hypothesized that the increase in plant height during the vegetative phase was influenced by the availability of sufficient macronutrients, particularly nitrogen, phosphorus, and potassium. This aligns with the view that during the vegetative phase, plants require ample nutrients for growth, particularly macronutrients. Nitrogen is a macronutrient that plays an integral role in chlorophyll synthesis for the photosynthesis process [8]. According to [9], macronutrients namely nitrogen, phosphorus, and potassium significantly influence plant height increase because these nutrients play a role in stimulating cell enlargement and division.

##### 3.1.1 Number of leaves

Observation data on the number of leaves 30 and 45 days after planting following the application of organic fertilizer indicate that this had no significant effect on tomato plant height at those stages, as shown in Table 2.

Table 2. Average number of leaves on tomato plants at 30 and 45 days after sowing following the application of organic fertilizer.

Compost Treatment ha <sup>-1</sup>	Number of leaves	
	30 days after transplanting	45 days after transplanting
Kontrol	16.88	20.25
10 ton/ha	17.89	20.11
20 ton/ha	17.22	20.63

Table 2 shows that plant height resulting from the application of organic fertilizer did not show significant differences across all treatments tested at 30 and 45 days after transplanting. It is hypothesized that the increase in the number and development of leaves is related to the optimal process of new tissue formation in the plants. Macronutrients such as nitrogen, phosphorus, and potassium play a role in supporting the synthesis of organic compounds required for leaf structure formation. This aligns with the findings [10], who noted that these elements are involved in chlorophyll formation and serve as key components in the synthesis of fats, proteins, and other compounds. Nitrogen plays a crucial role in enhancing plant height growth, stimulating bud formation, and supporting stem and leaf development. According to [11] nitrogen is the primary element in protoplasm and chlorophyll formation phosphorus plays a role in cell division and elongation while potassium aids in the transport of photosynthetic products to young tissues. According to [12] other factors affecting tomato plant growth include environmental conditions,

such as pest infestations that can lead to plant diseases. Consequently, the photosynthesis process is disrupted, preventing optimal plant growth.

**4.1.2 Fruit diameter, Number of fruits, Fruit weight per plant**

Data on fruit diameter, fruit yield, and fruit weight obtained from organic fertilization indicate that organic fertilization had no significant effect, as shown in Table 3.

Table 3. Average fruit diameter, fruit yield, and fruit weight of tomato plants resulting from the application of fertilizer organic

Compost Treatment ha <sup>-1</sup>	Fruit diameter	Number of fruits	Fruit weight per plant
Kontrol	32.47	7.33	301.49
10 ton/ha	37.86	7.52	299.41
20 ton/ha	36.65	8.07	302.81

Table 3 shows that fruit diameter resulting from the application of organic fertilizer did not show any significant differences across all treatments tested. It is hypothesized that increases in fruit diameter, fruit number, and fruit weight are related to the efficiency of the distribution of photosynthetic products from the leaves to the generative organs. When photosynthesis occurs optimally, the products of assimilation—known as photosynthates—are allocated more extensively to the fruit, thereby supporting increases in fruit size and weight. This aligns with the findings of Yoseva and [13], who noted that a balanced nutrient content can facilitate optimal photosynthesis and the plant’s ability to translocate photosynthates into the fruit, thereby influencing its size and weight. According to [14], nutrients such as magnesium (Mg), phosphorus (P), and potassium (K) synergistically contribute to improved fruit quality, including sugar content. [15]. [16] Their compositional balance must be maintained to prevent antagonistic effects between nutrients that can reduce absorption efficiency and physiological function. Potassium, in particular, plays a role in activating various carbohydrate synthesis enzymes, including glucose-starch synthase, glucose pyrophosphorylase, sucrose synthase, invertase, and phosphofructokinase [17]. [18] These enzymatic activities play a direct role in sugar accumulation within the fruit.

**4.2 The Effect of NPK Fertilizer**

**4.2.1 Plant Height (cm)**

Observation data on tomato plant height at 30 and 45 days after planting following the application of NPK fertilizer indicate that there was no significant effect on tomato plant height, as shown in Table 4.

Table 4. Average heights of tomato plants at 30 and 45 days after transplanting resulting from NPK fertilizer application

NPK treatment ha <sup>-1</sup>	Number of tillers	
	30 days after transplanting	45 days after transplanting
Kontrol	58.55	88.83
100 Kg/ha	59.12	89.04
200 Kg/ha	58.73	88.59

Table 4 shows that plant height at 30 and 45 days after transplanting did not show significant differences across all treatments tested. It is hypothesized that the increase in plant height was due to cell division and elongation stimulated by nutrient application. Consequently, metabolic activity within plant tissues produces organic matter to increase plant height through the formation of nutrients and organic compounds within the plant body to support plant growth and development. This aligns with [19], who states that the application of fertilizers containing N, P, and

K at appropriate doses will accelerate growth and increase plant height, whereas excessively high doses will slow plant growth. According to [20], the application of fertilizer at the correct dose and on a regular basis can stimulate plant growth

**3.1.1 Number of leaves**

Observation data on the number of leaves 30 and 45 days after planting following the application of NPK fertilizer indicate that this had no significant effect on tomato plant height at those stages, as shown in Table 5.

Table 5. Average tomato plant height at 30 and 45 days after transplanting following the application of NPK fertilizer.

NPK treatment ha <sup>-1</sup>	Number of tillers	
	30 days after transplanting	45 days after transplanting
Kontrol	16.22	21.28
100 kg/ ha	18.64	23.77
200 kg/ ha	17.46	22.52

Table 5 shows that plant height resulting from the application of NPK fertilizer did not show any significant differences across all treatments tested at 30 and 45 days after transplanting. It is hypothesized that leaf development is strongly influenced by the adequacy and balance of nutrients available to the plants. Leaves, as the primary organs of photosynthesis, require an adequate supply of nutrients to develop optimally, both in terms of number and surface area. If nutrient requirements are met in accordance with the plant’s characteristics, the leaf formation process will proceed more effectively. This aligns with [21] view that nutrient availability is critical because nutrients are absolutely essential for plants they must be present in very specific forms that cannot be replaced by other elements, and their quantities vary depending on the plant species, as nutrients for plants are akin to food for humans. [22] adds that the availability of nutrients that can be absorbed by plants is one of the factors that can influence the growth rate and crop yield if the nutrients provided through fertilization do not match a plant’s needs, the plant will not exhibit good growth and development..

**4.2.2 Fruit diameter, Number of fruits, Fruit weight per plant.**

Data on fruit diameter, fruit yield, and fruit weight resulting from the application of NPK fertilizer indicate that the application of NPK fertilizer has a significant effect on fruit diameter, fruit yield, and fruit weight in tomato plants, as shown in Table 6. Table 6 shows that fruit diameter, fruit number, and fruit weight of tomato plants treated with NPK fertilizer exhibited significant differences across all treatments. The highest values were observed in the 200 kg/ha treatment, at 41.98, 9.98, and 317.18, respectively. It is hypothesized that the increase in fruit weight is likely related to the optimal process of photosynthetic product accumulation within the fruit tissue. As a storage organ, the fruit receives assimilated products in the form of carbohydrates translocated from the leaves thus, the more effective this distribution process is, the greater the resulting fruit weight tends to be. This aligns with [23], who stated that potassium can influence fruit weight because potassium plays a role in carbohydrate transport. [24] Carbohydrates themselves play a role in increasing fruit sugar content and act as a catalyst, thereby leading to increased fruit weight. [25] found that the application of various doses of trichokompos and NPK fertilizers, along with their interactions in chili plants, had a significant effect on fruit weight per plant, with the highest

weight recorded for kompos at 100 g/plant and 10.94 g/plant for NPK fertilizer, resulting in a total fruit weight of 52.08 g.

Table 6. Average fruit diameter, fruit yield, and fruit weight of tomato plants resulting from the application of NPK fertilizer

NPK treatment ha <sup>-1</sup>	Fruit diameter	Number of fruits	Fruit weight per plant
Kontrol	37.61 a	7.34 a	294.43 a
100 kg/ ha	37.67 a	8.66 a	299.68 ab
200 kg/ ha	41.98 b	9.98 b	317.18 b
	2.25	1.56	21.60

The numbers followed by the same letter in the same column are not significantly different in Duncan's 5% test

#### 4. Conclusion

Based on the results and discussion above, Compost application had no significant effect on all observed parameters, likely due to its slow nutrient release. In contrast, NPK significantly increased fruit diameter, fruit number, and fruit weight, with the highest values observed at 200 kg/ha (41.98, 9.98, and 317.18, respectively), indicating the importance of readily available nutrients for fruit development. However, no significant effects were found on vegetative growth parameters.

#### Acknowledgements

The author would like to thank the entire team from the Universitas Islam Kebangsaan Indonesia and Universitas Samudra, the Agroclimatology and Agronomy Laboratory, Faculty of Agriculture, Universitas Papua for all the facilities provided to carry out this research.

#### References

- [1]. A Sari, D. I., Gresinta, E., & Noer, S. (2021). Efektivitas pemberian air kelapa (*Cocos nucifera*) sebagai pupuk organik cair terhadap pertumbuhan tanaman tomat (*Solanum lycopersicum*). *EduBiologia: Biological Science and Education Journal*, 1(1), 41-47.
- [2]. Suhardjadinata, S., Kurniati, F., & Lulu, D. H. N. (2020). Pengaruh inokulasi cendawan mikoriza arbuskular dan pupuk npk terhadap pertumbuhan dan hasil tomat (*Lycopersicum esculentum* Mill.). *Media Pertanian*, 5(1).
- [3]. Priambodo, A., & Pujiwati, H. (2023). Pengaruh Jenis Pupuk Organik Dan Dosis NPK Terhadap Pertumbuhan Dan Hasil Kedelai Pada Budidaya Jenuh Air. In *Prosiding Seminar Nasional Pertanian Pesisir* (Vol. 2, No. 1, pp. 120-129).
- [4]. Ardiyanto, W., & Jazilah, S. (2018). Pengaruh macam pupuk organik cair (poc) dan saat pemberian terhadap pertumbuhan dan produksi cabai merah (*Capsicum annum* L). *Biofarm: Jurnal Ilmiah Pertanian*, 14(2).
- [5]. Kurniawan, D., Tripama, B., & Widiarti, W. (2022). Respon pertumbuhan dan produksi tanaman tomat (*Lycopersicum esculentu*, Mill.) terhadap pemberian pupuk kandang sapi dan pupuk NPK pada tanah entisol. *National Multidisciplinary Sciences*, 1(2), 250-261.
- [6]. Amir, N., Marlina, N., Palmasari, B., Aluyah, C., Aminah, I. S., Rompas, J. P., & Rohman, N. (2022). Respon pertumbuhan dan hasil jagung manis (*Zea mays Saccharata* Sturt L.) terhadap pupuk organik cair asal limbah buahan dan NPK di lahan kering. *Agro Bali: Agricultural Journal*, 5(3), 498-503..
- [7]. Widiyanto, A., Budiyanto, S., & Lukiwati, D. R. (2022). Pertumbuhan dan Produksi Tomat (*Lycopersicum esculentum* Mill.) Akibat Perlakuan Pupuk NPK dan Pupuk Organik Cair Sabut Kelapa. *Jurnal Agroplasma*, 9(2), 123-136.
- [8]. Roslianti, M., Susanti, S., Irwansyah, C., & Wati, S. N. (2025). Pengaruh Dosis Berbagai Jenis Pupuk Organik Terhadap Pertumbuhan Dan Hasil Tanaman Tomat (*Lycopersicum esculentum*) Pada Tanah Podsolik Merah Kuning (PMK) Rokan Hilir. *Jagur Jurnal Agroteknologi*, 7(1), 41-48.

- [9]. Sari, S. L., Rahman Djuwansah, M., Trinurani Sofyan, E., Budiarto, R., Nur Istyami, A., & Wibawa Mukti, G. (2026). Shape-adjusted controlled-release fertilizer for enhancing nutrient efficiency and reducing residues in rice production. *Journal of Plant Nutrition*, 49(4), 782-801.
- [10]. Silaban, A., Arzita, A., & Fathia, N. M. E. (2024). *Pengaruh Pemberian Trichokompos dan Pupuk NPK 16: 16: 16 terhadap Pertumbuhan dan Hasil Tanaman Kacang Panjang (Vigna sinensis L.)* (Doctoral dissertation, UNIVERSITAS UNJA).
- [11]. Solihat, R. M. A., Syah, B., & Laksono, R. A. (2025). Pengaruh kombinasi dosis pupuk NPK dan konsentrasi pupuk organik cair limbah buah-buahan terhadap pertumbuhan dan hasil tanaman tomat (*Solanum lycopersicum*) varietas Gustavi F1. *Jurnal Agroplasma*, 12(2).
- [12]. Rakun, A., & Mertha, I. G. (2018). Pengaruh Kompos Terhadap Hasil Panen Tomat (*Lycopersicum esculentum* Mill). *Jurnal Pijar Mipa*, 13(1), 56-59.
- [13]. Daeli, E. N., Yoseva, S., Nurbaiti, N., & Armainsi, A. (2022). Peningkatan Pertumbuhan Dan Produksi Kedelai (*Glycine max* L) Terhadap Aplikasi Pupuk Kascing Dan Npk Pada Tanah Inceptisol. *Jurnal Agroteknologi Tropika*, 11(2), 74-85.
- [14]. Supriyanto, E. A., & Yulianto, W. (2022). Pengaruh konsentrasi zpt auksin dan panjang entres terhadap pertumbuhan bibit tanaman alpukat (*Persea americana* L.). *Innofarm: Jurnal Inovasi Pertanian*, 24(1).
- [15]. Inaya, N., Armita, D., & Hafsan, H. (2021). Identifikasi masalah nutrisi berbagai jenis tanaman di Desa Palajau Kabupaten Jeneponto. *Filogeni: Jurnal Mahasiswa Biologi*, 1(3), 94-102.
- [16]. Rietra, R. P., Heinen, M., Dimkpa, C. O., & Bindraban, P. S. (2017). Effects of nutrient antagonism and synergism on yield and fertilizer use efficiency. *Communications in soil science and plant analysis*, 48(16), 1895-1920.
- [17]. Imananda, Q. M. (2021). *Respon Pertumbuhan dan Hasil Tanaman Terung (Solanum Melongena L.) Akibat Waktu Aplikasi Pupuk Kalium dan Konsentrasi Giberelin* (Doctoral dissertation, UPN" VETERAN"JAWA TIMUR).
- [18]. Armita, D., & Alawiyatun, N. A. W. (2020). Studi pertumbuhan dan aktivitas enzim antioksidan pada kultur in vitro tomat akibat cekaman salinitas. *Plantropica: Journal of Agricultural Science*, 5(1), 64-73.]
- [19]. Riska, R., Alimuddin, S., & Robbo, A. (2025). Dose-Dependent Interaction Between Moringa Leaf Extract and NPK Fertilization on Vegetative Growth and Reproductive Biomass of Common Bean (*Phaseolus vulgaris* L.). *AGROGENESIS Journal of Sustainable Agriculture and Innovation*, 1(2), 191-200.
- [20]. Crista, F., Radulov, I., Imbrea, F., Manea, D. N., Boldea, M., Gergen (2023). The study of the impact of complex foliar fertilization on the yield and quality of sunflower seeds (*Helianthus annuus* L.) by principal component analysis. *Agronomy*, 13(8), 2074.
- [21]. Azizi, M., Untari, Y., Ritaqwin, Z., & Maulina, F. A. (2025). Effectiveness of Auxin and Gibberellin Hormone Application on Tomato Plant Growth and Yield (*Solanum Lycopersicum* L.). *SEAS (Sustainable Environment Agricultural Science)*, 9(2), 161-169.
- [22]. Harta, R. Y., Untari, Y., Azizi, M., & Widiarti, D. (2024). Effect of Giving Humic Acid and Npk Dosage on Increasing Long Bean Production.
- [23]. Harta, R. Y., Untari, Y., Azizi, M., & Widiarti, D. (2024). Pengaruh Pemberian Asam Humat Dan Dosis NPK Pada Peningkatan Produksi Kacang Panjang. *Jurnal Sains Pertanian*, 8(2), 82-87.
- [24]. Nurcahyani, E., Kurniadewi, L., Zulkifli, Z., & Martha, L. L. (2021). Efek pemberian ekstrak tomat (*Solanum lycopersicum* L.) terhadap kandungan karbohidrat dan pertumbuhan planlet angrek *Dendrobium striaenopsis*. *Agritrop: Jurnal Ilmu-Ilmu Pertanian (Journal of Agricultural Science)*, 19(1), 67-73
- [25]. Ilma, F. W., Alimuddin, S., & Syam, N. (2023). Respon Pertumbuhan dan Produksi Tanaman Cabai Keriting (*Capsicum annum* L.) terhadap Aplikasi Trichokompos dan NPK. *AGrotekMAS Jurnal Indonesia: Jurnal Ilmu Peranian*, 4(1), 29-36.