



The Effect of Liquid Organic Fertilizer Concentration and Pruning Time on the Growth and Production of Tomato (*Solanum lycopersicum*) Plants

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ABSTRACT

Tomato (*Solanum lycopersicum*) is an important horticultural commodity in Indonesia, widely consumed and cultivated due to its high economic value. However, its productivity can be increased through cultivation technologies such as the application of liquid organic fertilizer and pruning techniques. This study aimed to determine the effect of rabbit urine concentration and pruning time on the growth and production of tomato plants, as well as to determine the interaction between the two treatments. The study was arranged as a factorial randomized block design (RBD) consisting of two factors. The first factor was the concentration of rabbit urine: K₀ (0 ppm/control), K₁ (1500 ppm), K₂ (3000 ppm), and K₃ (4500 ppm). The second factor was the pruning time: S₁ (without pruning), S₂ (pruning 15 days after planting), and S₃ (pruning 30 days after planting). Each treatment combination was replicated three times, resulting in 36 experimental units. The results showed that the concentration of Liquid Organic Fertilizer significantly affected the number of fruits per plant, fruit weight per fruit, fruit weight per plant, and the length of the longest root. The best treatment was obtained at K₂ (3000 ppm), which produced an average number of fruits of 1.62 fruits/plant, fruit weight per fruit of 13.90 grams, fruit weight per plant of 36.99 grams, and the length of the longest root of 29.73 cm. Application of concentration 4500 ppm (K₃) actually reduced yields, presumably due to excess nutrients. In contrast, the pruning treatment (S₁, S₂, S₃) did not have a significant effect on all observed parameters. No interaction was found between concentration and pruning time on tomato plant growth and yield. Thus, the use of rabbit urine at a concentration of 3000 ppm without special treatment during pruning is recommended to increase the growth and yield of tomato plants.

Keywords : Liquid Organic Fertilizer, Pruning, Rabbit Urine, Tomato.

ABSTRAK

Tomat (*Solanum lycopersicum*) merupakan salah satu komoditas hortikultura penting di Indonesia yang banyak dikonsumsi dan dibudidayakan karena nilai ekonomisnya tinggi. Namun, produktivitasnya masih dapat ditingkatkan melalui teknologi budidaya seperti pemberian pupuk organik cair (POC) dan teknik pemangkasan (*pruning*). Penelitian ini bertujuan untuk mengetahui pengaruh konsentrasi POC urin kelinci dan saat pruning terhadap pertumbuhan dan produksi tanaman tomat, serta untuk mengetahui interaksi antar kedua perlakuan tersebut. Penelitian disusun secara faktorial dengan Rancangan Acak Kelompok (RAK) yang terdiri dari dua faktor. Faktor pertama adalah konsentrasi POC urine kelinci: K₀ (0 ppm/kontrol), K₁ (1500 ppm), K₂ (3000 ppm), dan K₃ (4500 ppm). Faktor kedua adalah saat pruning: S₁ (tanpa pruning), S₂ (pruning 15 HST), dan S₃ (pruning 30 HST). Setiap kombinasi perlakuan diulang tiga kali sehingga terdapat 36 satuan percobaan. Hasil penelitian menunjukkan bahwa konsentrasi POC berpengaruh nyata terhadap jumlah buah per tanaman, berat buah per buah, berat buah per tanaman, dan panjang akar terpanjang. Perlakuan

terbaik diperoleh pada K2 (3000 ppm), yang menghasilkan rata-rata jumlah buah 1,62 buah/tanaman, berat buah per buah 13,90 gram, berat buah per tanaman 36,99 gram, dan panjang akar terpanjang 29,73 cm. Pemberian POC 4500 ppm (K3) justru menurunkan hasil, diduga akibat kelebihan unsur hara. Sebaliknya, perlakuan saat pruning (S1, S2, S3) tidak memberikan pengaruh yang signifikan terhadap semua parameter yang diamati. Tidak ditemukan interaksi antara konsentrasi POC dan saat pruning terhadap pertumbuhan dan hasil tanaman tomat. Dengan demikian, penggunaan POC urin kelinci pada konsentrasi 3000 ppm tanpa perlakuan khusus saat pruning direkomendasikan untuk meningkatkan pertumbuhan dan produksi tanaman tomat.

Kata Kunci : POC, Prinning, Urine Kelinci, Tomat

INTRODUCTION

Tomato (*Solanum lycopersicum*) is one of the most economically important horticultural commodities and is widely cultivated and consumed in Indonesia. In addition to being consumed as a fresh vegetable, tomatoes are used as raw materials in the pharmaceutical, cosmetic, and food industries, including for sauces, tomato paste, and juice production. The horticultural sector has promising prospects since the domestic demand for horticultural products, including tomatoes, continues to increase. Tomato plants originate from Central and South America, particularly from regions extending from Mexico to Peru, and belong to the *Solanaceae* family (AK, 2015).

According to data from the Central Statistics Agency (BPS, 2023), According to BPS, in 2023, national tomato production had reached 206,780 quintals, showing an increase of 27.72% compared to 161,902 quintals in 2022. However, from 2019 to 2022, tomato production tended to decline—from 196,038 quintals in 2019 to 161,902 quintals in 2022. This indicates that tomato productivity in Indonesia remains unstable and requires innovations in cultivation practices to achieve sustainable yield improvements. Furthermore, as of 2004, Indonesia was still importing as much as 8,192,280 kg of tomatoes, both in fresh and processed forms, from various countries.

One of the key factors influencing tomato growth and yield is fertilization. Tomato plants require a balanced supply of macro- and micronutrients to support both vegetative and generative growth phases. Liquid organic fertilizer (LOF) is an environmentally friendly alternative that can partially replace chemical fertilizers.

One potential material for producing LOF is rabbit urine, which contains macronutrients such as nitrogen (N), phosphorus (P), and potassium (K), as well as micronutrients like magnesium (Mg) and calcium (Ca) (Siddiq, 2021). These elements play an important role in leaf, stem, and root formation during the vegetative phase. However, to maximize its effectiveness, rabbit urine must be properly fermented before application (Melelo, 2023).

In addition to fertilization, another cultivation technique that can improve tomato quality and productivity is pruning. Pruning is a technique that involves removing specific parts of the plant—particularly unproductive shoots or branches—to regulate growth and nutrient distribution. This technique promotes flowering and fruiting, accelerates photosynthesis, produces larger and cleaner fruits, reduces the risk of fruit rot caused by soil contact, and increases the overall market value of tomatoes (Ahmad et al., 2023). According to Subaedah and Sudirman Numba (2018), pruning also helps optimize generative growth by redirecting the plant's energy from excessive vegetative growth toward the formation of flowers and fruits.

Based on these considerations, it is necessary to Research the application of the application of rabbit urine-based liquid organic fertilizer and appropriate pruning time to enhance tomato growth and yield. This study aims to determine the effects of liquid organic fertilizer (LOF) application and pruning time on the growth and production of tomato (*Solanum lycopersicum*).

RESEARCH METHOD

This research was conducted in Kebunagung Village, Gutoko Hamlet, Kajen District, Pekalongan Regency, at an elevation of approximately 50–60 meters above sea level. The study took place over a period of three months, from March to June 2025.

The experiment employed a factorial design arranged in a Randomized Complete Block Design (RCBD) with three replications. A total of 12 treatment combinations were tested, each repeated three times, resulting in 36 experimental units. Each unit consisted of five sample plants, yielding a total of 216 plants, comprising 180 experimental plants and 36 reserve plants. The treatments consisted of two factors: rabbit urine liquid organic fertilizer (POC) concentration and pruning time. The first factor, POC concentration (K), consisted of four levels: K₀ = control, K₁ = 1500 ppm, K₂ = 3000 ppm, and K₃ = 4500 ppm. The second factor, pruning time (S), consisted of three levels: S₁ = no pruning, S₂ = 15 days after planting (DAP), and S₃ = 30 DAP.

Observed variables included plant height (cm), number of fruits per plant, fruit weight per fruit (g), fruit weight per plant (g), fruit diameter (mm), longest root length (cm), fresh biomass weight (g), and dry biomass weight (g). The collected data were analyzed using analysis of variance (ANOVA), and when significant differences were detected, further analysis was performed using the Least Significant Difference (LSD) test at the 5% significance level to determine treatment differences.

RESULTS AND DISCUSSION

The Effect of Liquid Organic Fertilizer Concentration

The use of rabbit urine as a source of liquid organic fertilizer (LOF) not only enhances soil fertility but also reduces farming costs and provides additional income opportunities for livestock farmers. Rabbit urine based fertilizer contains relatively high nutrient concentrations, with nitrogen (N) at 4%, phosphorus pentoxide (P₂O₅) at 2.8%, and potassium oxide (K₂O) at 1.2%. These values are

generally higher than those found in cow manure (N 1.21%; P₂O₅ 0.65%; K₂O 1.6%) and goat manure (N 1.47%; P₂O₅ 0.05%; K₂O 1.96%). In addition, rabbit urine fertilizer has an organic matter content with a C/N ratio of 10–12% and a pH ranging from 6.47 to 7.52 (Mmbaga et al., 2024). According to Sembiring et al. (2017), these characteristics make rabbit urine fertilizer effective in improving soil fertility and enhancing plant productivity.

The production process of liquid organic fertilizer using rabbit urine involves a fermentation stage that enriches its nutrient availability. As described by Masrurah et al. (2024), the fertilizer is prepared using 15 liters of rabbit urine as the main nutrient source, 200 mL of molasses as a carbohydrate substrate to stimulate microbial activity, and 200 mL of Effective Microorganisms 4 (EM4) as a microbial inoculant to accelerate the fermentation process. The mixture is sealed and left to ferment for approximately three weeks, during which beneficial microorganisms decompose organic matter and reduce unpleasant odors. After fermentation, the resulting liquid fertilizer is rich in nutrients and ready for application according to the desired concentration levels.

The findings of Masrurah et al. (2024) further demonstrated that the application of rabbit urine-based LOF at a concentration of 3000 ppm significantly improved several growth parameters of tomato plants, including plant height, stem diameter, and number of leaves. This indicates that the nutrient composition of rabbit urine, particularly its high nitrogen content, plays a crucial role in stimulating vegetative growth. Nitrogen is essential for chlorophyll formation and leaf development, phosphorus supports root growth and flowering, while potassium contributes to fruit formation and overall plant vigor. Therefore, the use of rabbit urine-based liquid organic fertilizer provides an environmentally friendly and cost-effective alternative to chemical fertilizers, capable of enhancing tomato growth and yield potential.

Table 1. Mean Values and Statistical Analysis of Liquid Organic Fertilizer Concentration Treatments

Treatment	Number of Fruits per Plant (fruits)	Fruit Weight per Fruit (g)	Longest Root Length (cm)
K ₀ = 0 ppm (Control)	1,31 b	20,99 b	23,27 b
K ₁ = 1500 ppm	1,49 b	23,07 ab	25,78 b
K ₂ = 3000 ppm	2,42 a	27,69 a	28,29 a
K ₃ = 4500 ppm	1,80 b	22,79 b	26,91 b

Note: Data analyzed using the Least Significant Difference (LSD) test at a 5% significance level.

The results of the study showed that the concentration of rabbit urine-based liquid organic fertilizer (LOF) had a significant to highly significant effect on several growth and yield parameters of tomato plants, particularly the number of fruits per plant, fruit weight per fruit, and the length of the longest root. The best results were obtained at the medium concentration level (K₂ = 3000 ppm), with an average of 2.42 fruits per plant, 27.69 g fruit weight per fruit, 73.63 g total fruit weight per plant, and 28.29 cm root length. These findings indicate that at this concentration, the availability of macro- and micronutrients in the LOF was optimal for plant uptake, thus enhancing photosynthesis, flower formation, and fruit development (Masrurroh et al., 2024).

The increase in fruit number and weight at the 3000 ppm concentration suggests that the nutrients supplied by the rabbit urine-based fertilizer were present in balanced proportions, supporting the physiological processes of flowering and fruiting. Essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K) play vital roles in these processes—nitrogen promotes vegetative growth and chlorophyll formation, phosphorus supports root and flower development, and potassium enhances fruit filling and quality (Rajapaksha et al., 2025).

Furthermore, the use of moderate to relatively high concentrations (3000–4500 ppm) of rabbit urine LOF can still promote vegetative growth; however, it should be noted that increases in plant height, fresh biomass, and dry biomass do not always correspond directly with higher fruit yield (Sembiring et al., 2017). This implies that excessive vegetative growth

may compete with reproductive development, highlighting the importance of applying the fertilizer at an optimal concentration to achieve maximum tomato productivity.

Effect of Pruning Time

Pruning is a cultivation practice used to stimulate flowering and fruiting in tomato plants. It enhances plant height growth, accelerates photosynthetic activity, promotes early flowering, and results in cleaner fruits with greater weight and faster ripening. Moreover, pruning reduces fruit deformities caused by soil contact and minimizes the incidence of disease and fruit rot, thereby increasing the market value of tomatoes (Ahmad et al., 2023). In tomato cultivation, pruning is typically performed on young shoots and apical buds to regulate plant growth and optimize the fruiting period. The main purpose of pruning is to produce larger, uniformly ripened fruits in a shorter time.

Pruning of the main branches helps control the number of growing shoots so that the energy produced through photosynthesis can be redirected from excessive vegetative growth toward fruit development and enlargement (St. Sabahannur & Herawati, 2017). According to Makmur (2020), an experiment using a randomized block design (RBD) with three levels of apical pruning—no pruning (control), pruning at 15 days after transplanting (DAT), and pruning at 30 DAT—showed that pruning at 30 DAT resulted in the best plant height and number of leaves. These findings suggest that the timing of pruning plays a crucial role in optimizing tomato plant growth and maximizing yield potential.

Table 1. Average Values and Statistical Analysis of Tomato Growth Response to Pruning Time Treatments

Treatment	Plant Height (cm)	Fruit Weight per Fruit (g)	Fruit Weight per Plant (g)	Longest Root Length (cm)	Fresh Shoot Biomass (g)	Dry Shoot Biomass (g)
S ₁ = Without pruning	110,37	21,93	49,11	24,93	108,45	16,93
S ₂ = Pruning at 15 DAT	116,68	23,12	49,80	26,03	127,18	19,13
S ₃ = Pruning at 30 DAT	122,25	25,85	62,70	27,22	120,83	18,47

Note: Data analyzed using the Least Significant Difference (LSD) test at a 5% significance level.

The results presented in Table 2 indicate that different pruning times did not have a significant effect on all observed growth and yield parameters of tomato plants, including plant height, fruit weight per fruit, total fruit weight per plant, longest root length, fresh biomass, and dry biomass. Although statistically not significant, numerical trends show that plants pruned at 30 days after transplanting (S₃) tended to have higher average values for most parameters compared to other treatments. The highest plant height (122.25 cm), fruit weight per fruit (25.85 g), fruit weight per plant (62.70 g), and root length (27.22 cm) were all observed in the S₃ treatment, followed by pruning at 15 days after transplanting (S₂), while the lowest values were generally found in plants without pruning (S₁).

These findings suggest that delayed pruning (30 HST) may slightly enhance vegetative and generative performance, likely due to improved light penetration and better air circulation, which can optimize photosynthesis and assimilate distribution to developing fruits. However, the differences were not statistically significant, implying that tomato plants were able to maintain relatively stable growth and yield regardless of pruning time.

Similar results were reported by Santos (2008), who found that side-shoot pruning carried out 2–4 weeks after transplanting (equivalent to 15–30 HST) had no significant influence on tomato yield, with only temporary effects on plant height. After several weeks, the plants recovered, and the differences among treatments diminished. Likewise, Keter and Muraya (2020) observed that pruning between 2–6 weeks after transplanting did

not cause significant differences in growth or yield, as the pruning intensity applied was relatively mild (maintaining one to two main stems).

Overall, the current study supports previous findings indicating that moderate pruning—especially when performed under similar environmental and management conditions—does not cause major physiological changes in tomato plants. While pruning at 30 HST may numerically improve some growth parameters, the effect was not strong enough to significantly influence final yield outcomes.

Interaction Between Rabbit Urine Liquid Organic Fertilizer (LOF) Concentration and Pruning Time

The interaction between rabbit urine-based liquid organic fertilizer (LOF) concentration and pruning time showed no significant effect on all observed parameters. This indicates that the two factors acted independently and did not influence each other. In other words, the effects of LOF concentration and pruning time can be applied separately, depending on the desired outcome. For instance, to enhance fruit weight, growers may focus on optimizing pruning time, whereas to increase fruit number, emphasis may be placed on determining the most effective LOF concentration.

The effect of liquid organic fertilizer (POC) is primarily related to nutrient availability. According to Asadu et al. (2024), increased microbial activity in liquid organic fertilizers enhances the availability of soil macronutrients due to the accelerated decomposition of organic matter. In contrast, pruning time influences photosynthate distribution and

canopy architecture, where early vegetative pruning promotes the development of a more balanced new canopy (Antony et al., 2021). Furthermore, the distribution of photosynthates among roots, stems, and fruits is strongly dependent on the sink-source balance regulated by the timing of pruning (Zhang et al., 2022).

In addition, the range of rabbit urine POC concentrations and the variation in pruning time applied in this study were likely insufficient to exert treatment pressure capable of generating distinct physiological responses in each treatment combination. This indication is supported by the finding that most main effects did not show statistically significant differences, thereby reinforcing the hypothesis that the applied POC dosages and pruning times remained within a range that was inadequate to elicit significant growth responses

CONCLUSION

The results of this study indicate that the concentration of rabbit urine-based liquid organic fertilizer (LOF) had a highly significant effect on the number of fruits per plant and a significant effect on fruit weight per fruit and the length of the longest root. The optimal concentration was found at $K_2 = 3000$ ppm, which produced the best overall growth and yield performance. In contrast, pruning time had no significant effect on any of the observed parameters, including plant height, number of fruits per plant, fruit weight per fruit, total fruit weight per plant, fruit diameter, longest root length, fresh biomass, and dry biomass. Furthermore, there was no significant interaction between LOF concentration and pruning time for any of the measured variables, indicating that both factors operated independently in influencing tomato growth and yield.

REFERENCES

Ahmad, N. S., Gubali, H., Dude, S., Program, A., Agroteknologi, S., Gorontalo, U. N., Agroteknologi, P. S., Pertanian, F., & Gorontalo, U. N. (2023). Pengaruh Pemangkasan dan Pengurangan Jumlah Buah Terhadap Hasil Tanaman Tomat

(*Lycopersicum esculentum* Mill.) The Effect of Pruning and Reduction of Number of Fruit on Tomato (*Lycopersicum esculentum* Mill.). *Jatt*, 12(2), 51–61.

AK. (2015). Latar Belakang Tanaman Tomat (*Solanum lycopersicum*). 151, 10–17.

Anthony, B. M., & Minas, I. S. (2021). Optimizing Peach Tree Canopy Architecture for Efficient Light Use, Increased Productivity and Improved Fruit Quality. *Agronomy*, 11(10), 1961. <https://doi.org/10.3390/agronomy11101961>

Asadu, C. O., Ezema, C. A., Ekwueme, B. N., Onu, C. E., Onoh, I. M., Adejoh, T., Ezeorba, T. P. C., Ogbonna, C. C., Otuh, P. I., Okoye, J. O., & Emmanuel, U. O. (2024). Enhanced efficiency fertilizers: Overview of production methods, materials used, nutrients release mechanisms, benefits and considerations. *Environmental Pollution and Management*, 1, 32–48. <https://doi.org/10.1016/j.epm.2024.07.002>

BPS. (2023). Produksi Tomat pada tahun 2023 di Provinsi Lampung sebanyak 206.780 Kuintal.

Keter, I. K., & Muraya, G. O. M. (2020). Pengaruh Sistem Penanaman dan Pemangkasan terhadap Pertumbuhan dan Hasil Tomat (*Solanum lycopersicon*). 7(3), 18–30. <https://doi.org/10.9734/AJAHR/2020/v7i330096>

Masruroh, D., Nasirudin, M., & Faizah, M. (2024). Pengaruh Konsentrasi Pupuk Organik Cair Urine Kelinci terhadap Pertumbuhan Vegetatif Tanaman Tomat (*Solanum lycopersicum*). 6(2), 27–32.

Melelo, S. S. (2023). Uji POC berbahan dasar campuran urine kelinci dengan daun Gamal dan batang pisang terhadap pertumbuhan tanaman Pakcoy (*Brassica rapa* L.) (*Brassica*

- rapa L.). 5, 1–14.
- Mmbaga, N., Ngongolo, K., Materu, S.T. (2024). Potential of rabbit urine as fertilizer on growth and production of *Brassica carinata* L. *Discover Agriculture*, 2(1), 10.1007/s44279-024-00106-2
- Praxis. (2022). Pengaruh konsentrasi dan frekuensi pemberian pupuk organik cair urine kelinci terhadap pertumbuhan dan hasil tanaman Zucchini (*Cucurbita pepo* L.). *Journal of Economic Perspectives*, 2(1), 1–4.
- Rajapaksha, P. M., Ruhuna, U., Munasinghe, U., Teknologi, K., Lanka, S., Madusanka, H., Teknologi, K., Lanka, S., Wijesundara, I., Teknologi, K., & Lanka, S. (2025). Pengaruh larutan pupuk organik terhadap pertumbuhan dan hasil tomat (*Lycopersicon esculentum* Mill). <https://doi.org/10.1007/s13165-024-00478-1>
- Rivki, M., Bachtiar, A. M., Informatika, T., Teknik, F., & Indonesia, U. K. (2017). Pertumbuhan dan Hasil Tanaman Tomat (*Solanum lycopersicum*) Pada Berbagai Konsentrasi Urine Kelinci. 3(112).
- Santos, B. M. (2008). Early Pruning Effects on ‘Florida-47’ and ‘Sungard’ Tomato. 18(September), 1–4.
- Sembiring, M. Y., Setyobudi, L., & Sugito, Y. (2017). Pengaruh dosis pupuk urin kelinci terhadap pertumbuhan dan hasil beberapa varietas tomat. 5(1), 132–139.
- Sholekhuddiin, M. (2023). Pengaruh Konsentrasi POC Terhadap Pertumbuhan Tanaman Tomat (*Solanum lycopersicum* L.) Varietas Tymoti. 6(2), 27–32.
- St. Sabahannur, S. S., & Herawati, L. (2017). Pertumbuhan Dan Produksi Tanaman Tomat (*Lycopersicon esculentum* Mill) Pada Berbagai Jarak Tanam Dan Pemangkasan. *AGROTEK: Jurnal Ilmiah Ilmu Pertanian*, 1(2), 32–42. <https://doi.org/10.33096/agrotek.v1i2.35>
- Subaedah, Sudirman Numba, dan S. (2018). Sukmawati : Pengaruh Pemangkasan terhadap Pertumbuhan dan Produksi berbagai Varietas Cabai Merah (*Capsicum annum* L.). 2(1).
- Zhang, S., Chen, H., & Pan, C. (2022). Effects of the Source–Sink Relationship on Walnut Nut Quality at the Scale of the Fruit–Bearing Branch. *Forests*, 13(7), 1034. <https://doi.org/10.3390/f13071034>

