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Effectiveness of Giving Orange and Tomato Juice to Optimize Potato Growth and Production

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Abstract: Fruit waste management has gained increasing attention as an eco-friendly approach to sustainable agriculture. The increasing accumulation of organic waste, particularly from fruit residues, poses a significant environmental challenge. Utilizing these waste materials for agricultural purposes can contribute to waste reduction and soil fertility improvement. This study aimed to evaluate the effects of orange and tomato juice application on the growth and yield of potato plants (*Solanum tuberosum* L.), considering the potential of fruit waste as an organic fertilizer. A Randomized Block Design (RBD) was employed with two treatments: orange juice and tomato juice, each at five concentration levels (0%, 25%, 50%, 75%, and 100%) with three replications, totaling 75 samples. The parameters observed included the number of leaves, stem height, number of tubers, and tuber weight. Data were analyzed using analysis of variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT). The results indicated that orange juice significantly increased leaf number, stem height, and tuber weight, while tomato juice had a limited effect. No significant interaction was observed between the two treatments. These findings highlight the potential of fruit waste as an alternative organic fertilizer for sustainable agriculture.

Keywords: Fruit waste; Orange juice; Potato; Sustainable agriculture; Tomato juice

Introduction

Potatoes (*Solanum tuberosum* L.) are one of the world's primary staple crops, ranking after rice, wheat, and maize. The demand for potatoes continues to grow alongside the expansion of potato-based industries. However, potato productivity in Indonesia remains low due to limited use of high-quality seeds and suboptimal conventional farming systems (Juwanda et al., 2022). One of the major challenges is farmers' reliance on expensive chemical fertilizers, which, when overused, have negative environmental impacts (Raju et al., 2020; Fauzan et al., 2021).

Sustainable utilization of natural resources, including organic waste such as fruit, has become a key focus in modern agricultural management. Orange and tomato waste is rich in bioactive compounds such as vitamin C, citric acid, potassium, and lycopene, which have been shown to support various physiological processes in plants, including photosynthesis, nutrient absorption, and root development (Mila et al., 2021; Narulita et al., 2022). Therefore, utilizing fruit waste as an organic fertilizer offers a promising and eco-friendly alternative for enhancing crop productivity.

Previous studies have shown that potassium in oranges plays a critical role in improving plant osmoregulation and metabolism, while lycopene in tomatoes has antioxidant properties that enhance plant resilience to environmental stress (Pantang et al., 2021; Sanjaya et al., 2021). By harnessing this fruit waste, it is

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possible to reduce dependency on synthetic chemical fertilizers, which are relatively expensive and negatively affect soil ecosystem sustainability (Waluyo, 2020).

This research is essential to address the challenge of integrating sustainable agricultural practices with organic waste management. Furthermore, the study aims to provide practical solutions for farmers to improve the efficiency of potato production while mitigating environmental pollution caused by unmanaged fruit waste.

Potatoes play a crucial role in meeting global food demands, particularly as a source of carbohydrates. With the world's population continuing to grow, innovative approaches are needed to increase agricultural productivity without harming the environment. Consequently, this study is not only scientifically significant but also strategically important in supporting food security and sustainable agricultural development in Indonesia.

Method

This study falls under the category of field experimental research aimed at evaluating the effect of orange juice and tomato juice applications on the growth and yield of potato plants (*Solanum tuberosum* L.). The research was conducted in Bangun Saribu Village, Silimakuta Sub-district, Simalungun Regency, North Sumatra, during the period from August to November 2021.

The collected data were analyzed using analysis of variance (ANOVA) to examine the effect of the treatments on the measured parameters. If significant effects were detected, the analysis was followed by Duncan's Multiple Range Test (DMRT) to identify significant differences among treatments.

This approach allows for a systematic evaluation of the treatments, thereby determining the impact of orange juice and tomato juice concentrations on the growth and yield of potato plants.

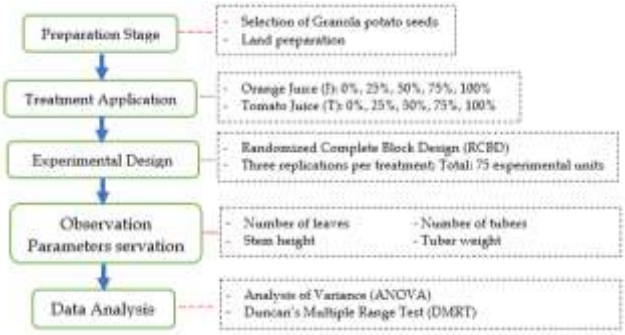

Figure 1. Flowchart of research methodology

Result and Discussion

Number of Leaves

The analysis results indicated that the application of orange juice significantly increased the number of potato leaves at 2, 3, and 4 Weeks After Planting (WAP) compared to tomato juice. The vitamin C and potassium content in orange juice is presumed to contribute to the acceleration of photosynthesis and leaf formation (Cahyo et al., 2020).

The data on the effect of orange juice and tomato juice on potato plant growth and production are presented below.

Table 1. ANOVA for Number of Leaves at 2 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Blocks	2	24.56	12.28	11.31218	0.0001***
Main Effects					
J (Orange Juice)	4	15.54666667	3.8866667	3.580348	0.0124*
T (Tomato Juice)	4	13.28	3.32	3.0583419	0.0253*
Interaction					
J x T	16	14.58666667	0.9116667	0.8398158	0.6365 ns
Error	48	52.10666667	1.0855556	-	
Total	74	120.08			
Model		67.97333333	2.614359	2.4083143	0.0041**

Note: *** = very significant (highly significant difference).

The analysis using Analysis of Variance (ANOVA) showed that the application of orange juice and tomato juice significantly affected the number of potato leaves at 2 Weeks After Planting (WAP), with a probability value of 0.0001 (***). These findings indicate that both treatments had a significant impact on the number of leaves compared to the control. However, the interaction between the two types of treatments did not show a significant effect (p = 0.6365).

The significant effects observed were likely due to the nutritional content of orange juice and tomato juice, such as vitamin C, potassium, and other bioactive compounds, which play a crucial role in supporting photosynthesis and cell division in leaves (Yanti et al., 2019; Sari et al., 2021; Yulianis et al., 2020). The effects of

orange and tomato juice treatments appeared to work independently, without any synergistic interaction in enhancing the number of leaves. It is suggested that the nutrient content in each juice is more dominant in determining the impact on plant growth than the combined effects of the two (Yanti et al., 2019).

The treatments of orange juice and tomato juice significantly influenced the increase in the number of potato leaves at 3 Weeks After Planting (3 WAP) in each replication. However, the interaction between the two treatments did not show a significant effect on the number of leaves at 3 WAP, with a probability value of 0.8033, as shown in Table 2.

Table 2. Analysis of Variance for Number of Leaves at 3 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	26.88	13.44	12.457261	0.0000 ***
J (Orange Juice)	4	22.74666667	5.6866667	5.2708548	0.0013 **
T (Tomato Juice)	4	7.013333333	1.7533333	1.6251287	0.1833 ns
Interaction					
J x T	16	11.65333333	0.7283333	0.6750772	0.8033 ns
Error	48	51.78666667	1.0788889	-	-
Total	74	120.08	-	-	-
Model	26	68.29333333	2.6266667	2.4346035	0.0037 **

The results of the analysis of variance in Table 2 show that the treatments of orange juice and tomato juice had varying effects on the number of potato leaves at 3 Weeks After Planting (WAP). The block factor had a highly significant effect on the results, with an F-value of 12.457 (p = 0.0000 ***), indicating the importance of environmental variability in influencing growth parameters.

The orange juice treatment significantly affected the number of leaves (F = 5.271, p = 0.0013 **). This is likely due to the nutrient content in orange juice, such as vitamin C, potassium, and citric acid, which support photosynthesis and leaf cell division. In contrast, tomato juice did not show a significant effect (F = 1.625, p = 0.1833 ns), possibly due to its suboptimal nutrient content for influencing leaf growth at the early stage.

The interaction between orange juice and tomato juice did not show a significant effect (F = 0.675, p = 0.8033 ns), indicating that both treatments acted independently without any synergistic or antagonistic effects. The overall model was significant at a probability of 0.0037 (**), with data variability being well-controlled (error = 1.079).

These findings suggest that orange juice is more effective than tomato juice in increasing the number of potato leaves during the early growth stage. Potassium and citric acid in orange juice likely play a dominant role in supporting the formation of vegetative tissues. Tomato juice may be more effective for other parameters or later growth stages.

These results are consistent with previous literature that emphasizes the importance of potassium in supporting plant leaf growth (Haque et al., 2022).

Table 3. Analysis of Variance for Number of Leaves at 4 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	30.90666667	5.453333	7.386086	0.0016 **
J (Orange Juice)	4	39.38666667	9.8466667	4.7063197	0.0028 **
T (Tomato Juice)	4	2.853333333	0.7133333	0.3409453	0.8490 ns
Interaction					
J x T	16	31.81333333	1.9883333	0.9503452	0.5218 ns
Error	48	100.4266667	2.0922222	-	
Total	74	205.3866667			
Model	26	104.96 4	0.036923	1.9294906	0.0241 *

Table 3 shows that the "block" factor had a highly significant effect on the number of potato leaves at 4 Weeks After Planting (WAP) (p = 0.0016 **). This indicates that the environmental variability between blocks influenced leaf growth, such as differences in soil, moisture, and light intensity, which can affect the leaf growth rate of potato plants.

The orange juice treatment (J) had a significant effect on the number of leaves (F = 4.70632, p = 0.0028 **), suggesting that the nutrients in orange juice, such as vitamin C and potassium, support photosynthesis and better leaf formation. In contrast, tomato juice (T) did not have a significant effect on the number of leaves at 4 WAP (p = 0.8490 ns), possibly due to its lower potassium content compared to orange juice, making it less

effective in supporting leaf growth at this stage (Sari et al., 2017).

The interaction between orange juice and tomato juice (J x T) did not have a significant effect (p = 0.5218 ns), meaning the two treatments worked independently without influencing each other. The decrease in the number of leaves in the potato plants at 4 WAP is likely due to the aging phase of the plant, where leaves begin to yellow and fall, which is part of the natural growth process of potato plants (Yusdian et al., 2019).

Although orange juice showed significant results, the decrease in the number of leaves was also influenced by the plant's age. Therefore, further research is needed to explore the effects of orange juice and tomato juice during other growth phases and determine the optimal dosage to support potato plant growth.

Stem Height

The results of the analysis of variance for the stem height of potato plants at 2 Weeks After Planting (2 WAP) are presented in Table 4.

Table 4. Analysis of Variance for Stem Height at 2 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	84.72426667	42.362133	35.300307	0.0000 ***
J (Orange Juice)	4	25.63386667	6.4084667	5.3401664	0.0012 **
T (Tomato Juice)	4	4.272533333	1.0681333	0.890074	0.4771 ns
Interaction					
J x T	16	19.0328	1.18955	0.9912504	0.4812 ns
Error	48	57.6024	1.20005		
Total	74	191.2658667		-	
Model	26	133.6634667	5.1409026	4.283907	0.0000 ***

Based on Table 4, the analysis of variance for stem height at 2 Weeks After Planting (2 WAP) indicates that the "block" factor has a highly significant effect (p = 0.0000***), meaning that environmental conditions between the blocks significantly influenced the stem height of the plants. Factors such as soil, humidity, and light can affect plant stem growth.

The orange juice (J) treatment showed a significant effect on stem height (F = 5.3402, p = 0.0012 **), likely due to its potassium and vitamin C content, which support photosynthesis and stem growth. However, the tomato juice (T) treatment did not show a significant effect (p = 0.4771 ns). Despite containing vitamin C and lycopene, the lower potassium content in tomato juice may not be sufficient to support stem height growth.

The interaction between orange juice and tomato juice (J x T) did not have a significant effect (p = 0.4812 ns), meaning that both treatments acted independently without any mutual influence.

These results suggest that environmental factors have a greater influence on stem height compared to the orange or tomato juice treatments during the early growth stage (Kartiko et al., 2021). Further research is needed to explore the effects of both types of juice on other growth phases and their optimal doses for supporting potato plant growth. The interaction between the two juice treatments (orange and tomato juice) showed no significant effect on stem height, as evidenced by the result of 0.4812.

Table 5. Analysis of Variance for Stem Height at 3 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	198.4714667	99.235733	36.619703	0.0000 ***
J (Orange Juice)	4	33.008	8.252	3.0451308	0.0257 *
T (Tomato Juice)	4	3.318666667	0.8296667	0.3061614	0.8724 ns
Interaction					
J x T	16	52.47333333	3.2795833	1.210223	0.2950 ns
Error	48	130.0752	2.7099		
Total	74	417.3466667			
Model	26	287.2714667	11.048903	4.0772363	0.0000 ***

Based on Table 5, the results of the analysis show that the "block" factor has a highly significant effect on the stem height of potato plants at 3 Weeks After Planting (3 WAP) (p = 0.0000 ***) with F = 36.619703. This indicates that environmental differences between the blocks, such as soil, humidity, and light intensity, affect stem growth. (Hidayah et al., 2017) state that environmental variation between experimental locations can influence plant morphology and physiology.

The orange juice (J) treatment also significantly affected stem height (F = 3.0451308, p = 0.0257 *). The

potassium, vitamin C, and bioactive compounds in orange juice are believed to enhance photosynthesis and accelerate cell division in the stems, contributing to stem growth (Lukmana & Sahab, 2021; Setiawan et al., 2020).

In contrast, the tomato juice (T) treatment did not show a significant effect on stem height (p = 0.8724 ns). Although tomato juice contains vitamin C and lycopene, its lower potassium content compared to orange juice may explain the lack of effect (Sari et al., 2021; Wijaya et al., 2019).

The interaction between orange juice and tomato juice (J x T) also did not show a significant effect on stem height (p = 0.2950 ns). This suggests that both treatments did not influence each other in promoting stem growth. These findings align with previous research highlighting the role of potassium in enhancing plant height while antioxidants such as lycopene primarily contribute to stress resistance rather than direct stem elongation.

Based on the Analysis of Variance (ANOVA) for stem height at 4 Weeks After Planting (4 WAP) (Table 6), several important observations can be made.

Table 6. Analysis of Variance for Stem Height at 4 WAP

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	132.8530667	66.426533	10.647875	0.0001 ***
J (Orange Juice)	4	27.37813333	6.8445333	1.097148	0.3688 ns
T (Tomato Juice)	4	15.83546667	3.9588667	0.6345886	0.6403 ns
Interaction					
J x T	16	76.08186667	4.7551167	0.7622239	0.7175 ns
Error	48	299.4469333	6.2384778		
Total	74	551.5954667			
Model	26	252.1485333	9.6980205	1.5545492	0.0918 ns

First, the block factor has a highly significant effect on the stem height of potato plants, with an F-value of 10.647875 and p = 0.0001 (p < 0.001). This indicates that differences in environmental conditions between blocks, such as soil variation, humidity, and light intensity, have a significant impact on stem growth.

State that variations in environmental factors can affect plant morphology, including stem height (Kurnianingsih et al., 2019; Kumar et al., 2020; Boguszewska-Mańkowska et al., 2022).

Second, the orange juice (J) treatment did not show a significant effect on stem height at 4 WAP, with p = 0.3688 (p > 0.05). Although orange juice contains potassium and vitamin C that could support plant growth, this treatment did not significantly affect stem height during this phase.

Third, the tomato juice (T) treatment also did not have a significant effect on stem height at 4 WAP, with p = 0.6403 (p > 0.05). Despite the presence of vitamin C and lycopene in tomato juice, its effect on stem height was not significant.

One potential reason for this could be the low potassium content in tomato juice, which plays an essential role in cell division and tissue formation in plants (Hasanuzzaman et al., 2018; Johnson et al., 2022).

Fourth, the interaction between orange juice and tomato juice (J x T) did not show a significant effect on stem height at 4 WAP, with p = 0.7175. This indicates that the two treatments did not influence each other in promoting stem height.

Number of Tubers

Here is the analysis of the Variance (ANOVA) for the number of potato tubers shown in Table 7.

Table 7. Analysis of Variance for the Number of Tubers

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	3.12	1.56	0.3506494	0.7060 ns
J (Orange Juice)	4	29.4133333	7.3533333	1.6528472	0.1765 ns
T (Tomato Juice)	4	3.54666667	0.8866667	0.1993007	0.9375 ns
Interaction					
J x T	16	62.0533333	3.8783333	0.8717532	0.6029 ns
Error	48	213.546667	4.4488889	-	
Total	74	311.68			
Model	26	98.13333333	3.774359	0.8483824	0.6685 ns

Based on the analysis of variance (ANOVA) for the number of potato tubers (Table 7), no significant effect was found from the treatments of orange juice and tomato juice on the number of tubers produced. The p-values for the block factor (P = 0.7060), orange juice (P = 0.1765), tomato juice (P = 0.9375), and the interaction

between them (P = 0.6029) are all greater than 0.05, indicating no significant impact of these treatments on the number of tubers. This suggests that both the environmental conditions between the experimental blocks and the treatments of orange juice and tomato juice did not substantially affect the number of potato tubers.

Factors influencing the number of potato tubers include seed quality and quantity, pest and disease control, and nutrient availability. In addition, genetic factors also play a crucial role in determining the number of tubers produced. Therefore, further research is needed to identify other factors that may increase the number of tubers and to test the effects of treatments during different growth stages of potato plants (Setiawan et al., 2017; Juwanda et al., 2022).

Potato Tubers Weight

The results of the Analysis of Variance (ANOVA) for the weight of potato tubers show significant differences among the tested factors, including experimental blocks, orange juice treatment, tomato juice treatment, and the interaction between the two (Table 8).

Table 8. Analysis of Variance for Potato Tubers Weight

Source	df	Sum of squares	Mean square	F-value	Probability
Block	2	19682.6667	9841.3333	7.0311979	0.0021 **
J (Orange Juice)	4	16114.6667	4028.6667	2.8783044	0.0324 *
T (Tomato Juice)	4	1994.6667	498.66667	0.3562753	0.8384 ns
Interaction					
J x T	16	1994.6667	3568.6667	2.5496547	0.0064 **
Error	48	67184.00	1399.6667	-	
Total	74	162074.6667			
Model	26	94890.66667	3649.641	2.6075073	0.0020 **

The results in Table 8 show that the factors tested-experimental blocks, orange juice treatment, tomato juice treatment, and their interaction-significantly affected the weight of the potato tubers. The block factor showed a significant variation (P = 0.0021, p < 0.05), which could be due to environmental differences between the experimental blocks, such as soil, humidity, and light intensity, which influence plant growth.

The orange juice treatment also had a significant effect on tuber weight (P = 0.0324, p < 0.05), with nutrients in orange juice, such as Vitamin C, potassium, and phosphorus, contributing to improved growth and tuber formation (Kurniawan, 2014). On the other hand, the tomato juice treatment did not show a significant effect (P = 0.8384, p > 0.05), despite containing compounds such as Vitamin C, potassium, and lycopene, which are known to support photosynthesis and disease resistance (Haque et al., 2022).

The interaction between orange juice and tomato juice showed a significant effect on tuber weight (P = 0.0064, p < 0.05), indicating that the combination of these two treatments was more effective than when applied separately. Overall, the combination of 0% orange juice and 25% tomato juice resulted in the highest tuber weight (9.33 g), while other combinations yielded lower results. This study suggests that orange juice has a significant effect on the weight of potato tubers, while tomato juice does not have the same effect. Further research is needed to explore the effects of varying concentrations and other factors that may influence potato tuber production.

Conclusion

This study demonstrated that orange juice application significantly improves potato growth and yield, particularly at concentrations of 50%-75%, making it a promising organic fertilizer alternative. In contrast, tomato juice showed limited benefits. These findings suggest that repurposing fruit waste can enhance agricultural sustainability and reduce chemical fertilizer dependency. The results may be applicable to other crops requiring high potassium inputs. Practically, integrating fruit waste as an organic amendment could offer cost-effective solutions for farmers while minimizing environmental pollution. Further research is recommended to explore long-term soil health impacts and applicability to broader agricultural systems.

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Author Contributions

The following statements should be Jamilah Nasution, Riyanto, Riris Sitorus, E. H. Kardhinata, and Edi Azwar used Conceptualization contributed to the data collection process, data processing, article writing.

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Conflicts of Interest
The authors declare no conflict of interest.

References

Boguszewska-Mańkowska, D., Zarzyńska, K., & Wasilewska-Nascimento, B. (2022). Potato (Solanum tuberosum L.) Plant Shoot and Root Changes under Abiotic Stresses—Yield Response. *Plants*, *11*(24). https://doi.org/10.3390/plants11243568

Cahyo, A. N., Murti, R. H., & Putra, E. T. S. (2020). Dampak kekeringan terhadap proses fisiologis, pertumbuhan, dan hasil tanaman karet (Hevea brasiliensis Mull. Arg.). *Warta Perkaretan*, *39*(1). https://doi.org/10.22302/ppk.wp.v39i1.664

Fauzan, N. D., Ardan, M., Izzah Safina, A.-N., Fattur, R., & Octalyani, E. (2021). Penggunaan Pupuk Organik Cair sebagai Pengganti Pupuk Kimia di Desa Sidomulyo, Kecamatan Air Naningan. *Altruis: Journal of Community Services*, *2*(2). https://doi.org/10.22219/altruis.v2i2.15977

Haque, T., Bhaskara, G. B., Yin, J., Bonnette, J., & Juenger, T. E. (2022). Natural variation in growth and leaf ion homeostasis in response to salinity stress in Panicum hallii. *Frontiers in Plant Science*, *13*. https://doi.org/10.3389/fpls.2022.1019169

Hasanuzzaman, M., Bhuyan, M. H. M. B., Nahar, K., Hossain, M. S., Al Mahmud, J., Hossen, M. S., Masud, A. A. C., Moumita, & Fujita, M. (2018). Potassium: A vital regulator of plant responses and tolerance to abiotic stresses. In *Agronomy* (Vol. 8, Issue 3). https://doi.org/10.3390/agronomy8030031

Johnson, R., Vishwakarma, K., Hossen, M. S., Kumar, V., Shackira, A. M., Puthur, J. T., Abdi, G., Sarraf, M., & Hasanuzzaman, M. (2022). Potassium in plants: Growth regulation, signaling, and environmental stress tolerance. In *Plant Physiology and Biochemistry* (Vol. 172). https://doi.org/10.1016/j.plaphy.2022.01.001

Juwanda, M., Zikri, I., & Agussabti, A. (2022). Persepsi Petani Dan Penyuluh Terhadap Teknologi Smart Farming Kentang Di Kabupaten Bener Meriah. *Jurnal Ilmiah Mahasiswa Pertanian*, *7*(4). https://doi.org/10.17969/jimfp.v7i4.22001

Kartiko, Susilastuti, & Husni. (2021). Pengaruh Dosis Pupuk Organik Cair Kulit Nanas Terhadap Pertumbuhan Bibit Kelapa Sawit (Elaeis guineensis Jacq.) di Pre Nursery. *Agroscience (AGSCI)*, *11*(2). https://doi.org/10.35194/agsci.v11i2.1833

Kumar, P., Kumar, T., Singh, S., Tuteja, N., Prasad, R., & Singh, J. (2020). Potassium: A key modulator for cell homeostasis. *Journal of Biotechnology*, *324*. https://doi.org/10.1016/j.jbiotec.2020.10.018

Kurnianingsih, A., Susilawati, S., & Hayatullah, R. (2019, March). Respon pertumbuhan dan hasil tanaman bawang merah (Allium Cepa L.) varietas bima pada berbagai komposisi media tanam. In *Seminar Nasional Lahan Suboptimal* (pp. 120-128). Retrieved from https://conference.unsri.ac.id/index.php/lahansuboptimal/article/view/1221

Mila Rahni, N., Ode Afa, L., Zulfikar, Z., Siti Anima Hisein, W., & Febrianti, E. (2021). Respons Pertumbuhan Dan Hasil Tanaman Okra (Abelmoschus esculentus) Yang Diberi Pelakuan Pupuk Organik Cair Berbasis Limbah Pasar. *Jurnal Agrium*, *18*(1). https://doi.org/10.29103/agrium.v18i1.3837

Narulita, N., Hasibuan, S., & Mawarni, R. (2022). Pengaruh Sistem dan Konsentrasi Nutrisi Terhadap Pertumbuhan dan Produksi Tanaman Pakcoy (Brassica Rapa L.) Secara Hidroponik. *Galang Tanjung*, *15*(3). Retrieved from https://jurnal.una.ac.id/index.php/jb/article/view/1307

Pantang, L. S., Yusnaeni, Y., Ardan, A. S., & Sudirman, S. (2021). Efektivitas Pupuk Organik Cair Limbah Rumah Tangga dalam Meningkatkan Pertumbuhan dan Produksi Tanaman Tomat (Lycopersicum esculentum Mill.). *EduBiologia: Biological Science and Education Journal*, *1*(2). https://doi.org/10.30998/edubiologia.v1i2.8966

Raju, Ayu, P. C., Fatoni, R. B. Moh. I., Supriana, T., Pane, T. C., & Khaliqi, M. (2020). Meningkatkan Produktivitas Tanaman Kentang dengan Manajemen Pemupukan [Improving Potato Productivity with Fertilizing Management]. *Talenta Conference Series: Agricultural and Natural Resources (ANR)*, *3*(2). Retrieved from https://talentaconfseries.usu.ac.id/anr/article/view/940

Sanjaya, P., Kurnia, N., Kushendarto, K., & Yelli, F. (2021). Pengaruh Pupuk Kandang Dan Pupuk Hayati Pada Pertumbuhan Dan Produksi Tanaman Tomat (Lycopersicum esculentum Mill.). *Jurnal Agrotek Tropika*, *9*(1). https://doi.org/10.23960/jat.v9i1.4895

Sari, B. P., Suwerda, B., & Istiqomah, S. H. (2017). Pemanfaatan Limbah Tomat Sebagai Pupuk Organik Cair Di Pasar Giwangan, Yogyakarta. *Sanitasi: Jurnal Kesehatan Lingkungan*, *8*(4). https://doi.org/10.29238/sanitasi.v8i4.69

Sari, L. D. A., Kurniawati, E., Ningrum, R. S., & Ramadani, A. H. (2021). Kadar Vitamin C Buah Tomat (Lycopersicum esculentum Mill) Tiap Fase Kematangan Berdasar Hari Setelah Tanam. *Jurnal*

Farmasi Dan Ilmu Kefarmasian Indonesia, *8*(1). https://doi.org/10.20473/jfiki.v8i12021.74-82

Setiawan, H. K., Ainurrasyid, A., & Kuswanto, K. (2017). Respon Enam Generasi Kentang (Solanum tuberosum L.) Terhadap Pemberian Pyraclostrobin Di Dataran Medium. *Jurnal Produksi Tanaman*, *4*(7). Retrieved from https://protan.studentjournal.ub.ac.id/index.php/protan/article/view/325

Waluyo, T. (2020). Analisis Finansial Aplikasi Dosis dan Jenis Pupuk Organik Cair Terhadap Produksi Tanaman Tomat (Lycopersicum esculentum Mill). *Jurnal Ilmu dan Budaya,* *41*(70). https://doi.org/10.47313/jib.v41i70.930

Yanti, P. D., Devianti, V. A., & Wardani, R. K. (2019). *Pengaruh lama waktu konsumsi dan penambahan gula terhadap kadar vitamin c pada jus buah jeruk manis*. Akademi Farmasi Surabaya. Retrieved from http://repository.akfarsurabaya.ac.id/id/eprint/60

Yulianis, Hairani, & Sutrisno, D. (2020). Analisa Vitamin C Kulit Jeruk Manis (Citrus Sinensis (L.) Osbeck) Dengan Spektrofotometri Uv-Visible. *Jurnal Katalisator*, *5*(2).

Yusdian, Y., Kantikowati, E., & Yanto, R. (2019). Keragaan vegetatif dan hasil tanaman kentang varietas granola akibat aplikasi pupuk NPK (15: 15: 15). *Jurnal Ilmiah Pertanian*, *2*(1). https://doi.org/10.55222/agrotatanen.v2i1.348