UNIVERSITAS GADJAH MADA
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REFERENCES

Affifah, N.H.F. and Siswanti, D.U. 2022. Growth response, chlorophyll content, and nitrate reductase activity of mustard greens (*Brassica rapa* L.) to salinity stress post application of biofertilizer in hydroponic system. *Biogenesis Jurnal Ilmiah Biologi* 10(2), 155–167. Available at: https://doi.org/10.24252/bio.v10i2.29505.

Alam, P., Arshad, M., Al-Kheraif, A.A., Azzam, M.A. and Balawi, T.A. 2022. Silicon Nanoparticle-Induced Regulation of Carbohydrate Metabolism, Photosynthesis, and ROS Homeostasis in *Solanum lycopersicum* Subjected to Salinity Stress. *ACS Omega* 7(36), 31834–31844. Available at: https://doi.org/10.1021/acsomega.2c02586.

Ali, A. 2020. Nitrate assimilation pathway in higher plants: critical role in nitrogen signalling and utilization. *Plant Science Today* 7(2), 182–192. Available at: https://doi.org/10.14719/pst.2020.7.2.637.

Ali, M.Y. et al., 2021. Nutritional composition and bioactive compounds in tomatoes and their impact on human health and disease: a review. *Foods* 10(1), 45. Available at: https://doi.org/10.3390/foods10010045.

Amin, M., Juita, N. and Asnawi, N. 2023. Application of nano silica fertilizer in agricultural sustainability (a review). *IOP Conference Series Earth and Environmental Science* 1230(1), 012063. Available at: https://doi.org/10.1088/1755-1315/1230/1/012063.

Beleri, P.S. 2023. Microbial solutions to soil health: The role of biofertilizers in Sustainable agriculture. *Environmental Reports*. 5(2), 6–9. Available at: https://doi.org/10.51470/er.2023.5.2.06.

Berwal, M.K. and Ram, C. 2019. Superoxide dismutase: a stable biochemical marker for abiotic stress tolerance in higher plants. In: *IntechOpen eBooks*. Available at: https://doi.org/10.5772/intechopen.82079.

Bhatt, P. and Singh, V.K. 2022. Effect of humic acid on soil properties and crop production– A review. *The Indian Journal of Agricultural Sciences* 92(12). Available at: https://doi.org/10.56093/ijas.v92i12.124948.

BPS. 2024. *Produksi tanaman sayuran - tabel statistik*. Available at: https://www.bps.go.id/id/statistics-table/2/NjEjMg==/produksi-tanaman-sayuran.html [Accessed: 18 April 2025].

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Canellas, L.P. and Olivares, F.L. 2014. Physiological responses to humic substances as plant growth promoter. *Chemical and Biological Technologies in Agriculture* 1(1), 3. Available at: https://doi.org/10.1186/2196-5641-1-3.

Charan, K. and Bhattacharyya, P. 2023. Vermicomposted red mud- An up-and-coming approach towards soil fertility and crop quality. *Journal of Crop and Weed* 19(2), 36–51. Available at: https://www.cabidigitallibrary.org/doi/pdf/10.5555/20230444100.

Danususila, H. 1989. *Kajian Pengaruh Nitrogen dari Pupuk Buatan terhadap Aktivitas Nitrat Reduktase pada Daun Bawang Purih (Allium sativum L.)*. Skripsi, Universitas Gadjah Mada.

English, C. 2022. Understanding the Origins of Siloxane Ghost Peaks in Gas Chromatography. Available at: https://www.chromatographyonline.com/view/understanding-the-origins-of-siloxane-ghost-peaks-in-gas-chromatography.

Erfani-Moghadam, J. and Zarei, A. 2025. Calcium and silicon nanofertilizers improved morphological attributes and fatty acid composition in olive; an insight to synergistic interaction between these elements. *BMC Plant Biology* 25(1), 997. Available at: https://doi.org/10.1186/s12870-025-07027-2.

Fernandez, E.O.C. 2012. Effect of Soil Nutrient on Production and Diversity of Volatile Terpenoids from Plants. *Current Bioactive Compounds* 8(1), 71–79. Available at: https://doi.org/10.2174/157340712799828188.

Gargiulo, S., Ruocco, M., Loreto, F., Faino, L. and Monti, M.M. 2025. Volatile organic compounds in *Solanum lycopersicu*m leaves and their roles in plant protection. *Horticulture Research* 12(10), uhaf181. Available at: https://doi.org/10.1093/hr/uhaf181.

Himatkhwah, R., Salihi, M.S., Faizi, M. and Afghan, M.K. 2025. Impacts of humic acid on growth, yield, and quality of tomato: a review. *Journal of Natural Science Review* 3(3), 96–110. Available at: https://doi.org/10.62810/jnsr.v3i3.215.

UNIVERSITAS GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Jote, C.A. 2023. The Impacts of Using Inorganic Chemical Fertilizers on the Environment and Human Health. *Organic & Medicinal Chemistry International Journal* 13(3), 555864.

Karimi, J. and Mohsenzadeh, S. 2016. Effects of silicon oxide nanoparticles on growth and physiology of wheat seedlings. *Russian Journal of Plant Physiology* 63(1), 119–123. Available at: https://doi.org/10.1134/s1021443716010106.

Kittas, C., Katsoulas, N., Rigakis, V., Bartzanas, T. and Kitta, E. 2012. Effects on microclimate, crop production and quality of a tomato crop grown under shade nets. *The Journal of Horticultural Science and Biotechnology* 87(1), 7–12. Available at: https://doi.org/10.1080/14620316.2012.11512822.

Kroumova, A.B., Xie, Z. and Wagner, G.J. 1994. A pathway for the biosynthesis of straight and branched, odd- and even-length, medium-chain fatty acids in plants. Proceedings of the *National Academy of Sciences* 91(24), 11437–11441. Available at: https://doi.org/10.1073/pnas.91.24.11437.

López-Gresa, M.P. et al., 2017. A Non-targeted Metabolomics Approach Unravels the VOCs Associated with the Tomato Immune Response against *Pseudomonas syringae*. *Frontiers in Plant Science* 8, 1188. Available at: https://doi.org/10.3389/fpls.2017.01188.

Marklund, S. and Marklund, G. 1974. Involvement of the superoxide anion radical in the autoxidation of pyrogallol and a convenient assay for superoxide dismutase. *European Journal of Biochemistry* 47(3), 469–474. Available at: https://doi.org/10.1111/j.1432-1033.1974.tb03714.x.

Mathur, P. and Roy, S. 2020. Nanosilica facilitates silica uptake, growth and stress tolerance in plants. *Plant Physiology and Biochemistry* 157, 114–127. Available at: https://doi.org/10.1016/j.plaphy.2020.10.011.

Matisic, M., Dugan, I. and Bogunovic, I. 2024. Challenges in Sustainable Agriculture—The role of Organic Amendments. *Agriculture* 14(4), 643. Available at: https://doi.org/10.3390/agriculture14040643.

Matsui, K. and Engelberth, J. 2022. Green Leaf Volatiles—The forefront of plant responses against biotic attack. *Plant and Cell Physiology* 63(10), 1378–1390. Available at: https://doi.org/10.1093/pcp/pcac117.

UNIVERSITAS GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Mehata, D.K., Kattel, I., Sapkota, P., Ghimire, N.P. and Mehta, R.K. 2023. BIOFERTILIZERS: a SUSTAINABLE STRATEGY FOR ORGANIC FARMING THAT WOULD INCREASE CROP PRODUCTION AND SOIL HEALTH. *Deleted Journal* 3(2), 49–53. Available at: https://doi.org/10.26480/ppsc.02.2023.49.53.

Mustafa, M., Mwangi, R.W., Szalai, Z., Kappel, N. and Csambalik, L. 2025. Sustainable responses to open field tomato (*Solanum lycopersicum* L.) stress impacts. *Journal of Agriculture and Food Research* 21, 101825. Available at: https://doi.org/10.1016/j.jafr.2025.101825.

Nabi, F., Sarfaraz, A., Kama, R., Kanwal, R. and Li, H. 2025. Structure-Based Function of humic acid in abiotic stress alleviation in plants: A review. Plants 14(13), 1916. Available at: https://doi.org/10.3390/plants14131916.

Nabi, N., Singh, S. and Saffeullah, P. 2023. An updated review on distribution, biosynthesis and pharmacological effects of artemisinin: A wonder drug. *Phytochemistry* 214, 113798. Available at: https://doi.org/10.1016/j.phytochem.2023.113798.

Nelson-Schreiber, B.M. and Schweitzer, L.E. 1986. Limitations on Leaf Nitrate Reductase Activity during Flowering and Podfill in Soybean. *PLANT PHYSIOLOGY* 80(2), 454–458. Available at: https://doi.org/10.1104/80.2.454.

Padhan, B.K., Sathee, L., Kumar, S., Chinnusamy, V. and Kumar, A. 2023. Variation in nitrogen partitioning and reproductive stage nitrogen remobilization determines nitrogen grain production efficiency (NUEg) in diverse rice genotypes under varying nitrogen supply. *Frontiers in Plant Science* 14, 1093581. Available at: https://doi.org/10.3389/fpls.2023.1093581.

Reddy, P.S., Reddy, N.G., Serjun, V.Z., Mohanty, B., Das, S.K., Reddy, K.R. and Rao, B.H. 2020. Properties and assessment of applications of red mud (Bauxite residue): current status and research needs. *Waste and Biomass Valorization* 12(3), 1185–1217. Available at: https://doi.org/10.1007/s12649-020-01089-z.

Saptana, N. et al., 2023. Competitiveness analysis of fresh tomatoes in Indonesia: Turning comparative advantage into competitive advantage. *PLoS ONE*

UNIVERSITAS GADJAH MADA
Effect of Biofertilizer and Soil Amendments on Growth and Physiological Responses of Tomato (Solanum Lycopersicum L.)
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

18(11), e0294980. Available at: https://doi.org/10.1371/journal.pone.0294980.

Shukla, P., Bajpai, K., Tripathi, S., Kumar, S. and Kumar Gautam, G. 2013. A Review on the Taxonomy, Ethnobotany, Chemistry and Pharmacology of *Solanum Lycopersicum* Linn. *International Journal of Chemistry and Pharmaceutical Sciences* 1(8), 521–527. Available at: https://www.pharmaresearchlibrary.com/ijcps.

Siswanti, D.U. and Rachmawati, D. 2013. Pertumbuhan Tiga Kultivar Padi (Oryza sativa L.) Terhadap Aplikasi Pupuk Bio Cair dan Kondisi Tanah Pertanian Pasca Erupsi Merapi 2010. *Biogenesis Jurnal Ilmiah Biologi* 1(2), 110–115. Available at: https://doi.org/10.24252/bio.v1i2.456.

Siswanti, D.U. and Riesty, O.S. 2021. Effects of biofertilizer and manure application on growth rate and chlorophyll content of spinach (*Amaranthus tricolor* L.) under salinity stress condition. *BIO Web of Conferences* 33, 05003. Available at: https://doi.org/10.1051/bioconf/20213305003.

Siswanti, D.U. and Umah, N. 2021. Effect of Biofertilizer and Salinity on Growth and Chlorophyll Content of *Amaranthus tricolor* L. *IOP Conference Series Earth and Environmental Science* 662(1), 012019. Available at: https://doi.org/10.1088/1755-1315/662/1/012019.

Siswanti, D.U., Utaminingsih, U., Lestari, M.F. and Hamdian, H. 2019. Application of Bio Fertilizer and Biogas Sludge to Curly Red Chili (*Capsicum annuum* L.) at Wukirsari Village, Cangkringan, Sleman. *Jurnal Pengabdian Kepada Masyarakat* 5(3), 371. Available at: https://doi.org/10.22146/jpkm.46266.

Soval-Villa, M., Wood, C.W. and Guertal, E.A. 2002. TOMATO LEAF CHLOROPHYLL METER READINGS AS AFFECTED BY VARIETY, NITROGEN FORM, AND NIGHTTIME NUTRIENT SOLUTION STRENGTH. *Journal of Plant Nutrition* 25(10), 2129–2142. Available at: https://doi.org/10.1081/pln-120014065.

Suryono, E. 2016. ANALISIS NITRAT REDUKTASE SECARA “IN-VIVO” PADA TANAMAN JAGUNG, KACANG HIJAU, TEBU, UWI DAN

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

CABAI. *Integrated Lab Journal* 4(1), 11–18. Available at: http://ejournal.uin-suka.ac.id/pusat/integratedlab/article/view/1533.

Vuković, J., Perušić, M., Stopić, S., Kostić, D., Smiljanić, S., Filipović, R. and Damjanović, V. 2024. A review of the red mud utilization possibilities. *Analele Universităţii "Ovidius" Constanţa. Seria Chimie/"Ovidius" University Annals of Chemistry* 35(2), 165–173. Available at: https://doi.org/10.2478/auoc-2024-0021.

Xu, J., Lu, Y., Cui, J., Liu, Y., Yu, W. and Li, C. 2026. Unraveling the difference in aroma characteristics of tomato flesh with different colors using HS-SPME-GC–MS/MS and E-nose combined with multivariate data analysis. *Food Chemistry X* 34, 103594. Available at: https://doi.org/10.1016/j.fochx.2026.103594.

Xu, Y., Li, M., Ding, H., Ma, Y., Yang, Y. and Feng, L. 2025. Comparative effects of humic acid biostimulation on soil properties, growth, and fragrance of Rosa rugosa. *Industrial Crops and Products* 225, 120444. Available at: https://doi.org/10.1016/j.indcrop.2024.120444.

Ye, L., Zhao, X., Bao, E., Li, J., Zou, Z. and Cao, K. 2020. Bio-organic fertilizer with reduced rates of chemical fertilization improves soil fertility and enhances tomato yield and quality. *Scientific Reports* 10(1). Available at: https://doi.org/10.1038/s41598-019-56954-2.

Yuan, Z. et al., 2016. Optimal leaf positions for SPAD meter measurement in rice. *Frontiers in Plant Science* 7. Available at: https://doi.org/10.3389/fpls.2016.00719.

Zhang, S. 2025. Effect of Soil pH on Tomatoes. *World Scientific Research Journal* 11(10), 54–6