

DAFTAR PUSTAKA

- Adelia, P. F., Koesriharti, K., & Sunaryo, S. 2013. Pengaruh Penambahan Unsur Hara Mikro (Fe dan Cu) dalam Media Paitan Cair dan Kotoran Sapi Cair terhadap Pertumbuhan dan Hasil Kangkung darat Merah (*Amaranthus tricolor* L.) dengan Sistem Hidroponik Rakit Apung. *Jurnal Produksi Tanaman*, **1**(3): 48-58.
- Afrijal, Syuhada, F. A., Jarlis, R., & Hendrita, V. 2024. Teknik Budidaya Tanaman Kangkung Darat (*Ipomoea reptans* Poir) secara Organik di CV. Faruq Farm. *Jurnal Agriness*, **2**(1): 7-12.
- Ahmad, I., Makkulawu, A. R., & Fattah, N. 2023. *Nanoteknologi dan Aplikasinya dalam Produksi Pertanian dan Pangan*. Eureka Media Aksara. Purbalingga.
- Alpandari, H. & Prakoso, T. 2024. Respon Pertumbuhan Tanaman Kangkung (*Ipomoea reptans* Poir.) terhadap Pemberian Hara Mikro melalui Akar dan Daun. *PUCUK: Jurnal Ilmu Tanaman*, **4**(1): 1-8.
- Altammar, K. A. 2023. A Review on Nanoparticles: Characteristics, Synthesis, Applications, and Challenges. *Frontiers in Microbiology*, **14**(1): 1-20.
- Andarini, Y. N., Afza, H., & Sutoro, S. 2020. Pendugaan Luas Daun Tanaman Talas (*Colocasia esculenta*). *Jurnal Ilmu Pertanian Indonesia*, **25**(4): 610-617.
- Azam, R., Malik, K., Sultana, T., Arooj, F., & Kazmi, A. 2025. Plant-Mediated Bioinspired Iron Nanoparticles as An Alternative to Enhance Crop Resistance Against Biotic and Abiotic Stress; A Review. *Physiological and Molecular Plant Pathology*, **136**(1): 1-12.
- Bahtiar, E. T., Nugroho, N., Surjokusumo, S., Karlinasari, L., & Darwis, A. 2013. Analisis *Layer System* Bambu Laminasi Berdasarkan Penyebaran Kerapatan Ikatan Pembuluhnya. *Jurnal Ilmu Pertanian Indonesia*, **18**(1): 29-42.
- Bala, R., Kalia, A., & Dhaliwal, S. S. 2019. Evaluation of Efficacy of ZnO Nanoparticles as Remedial Zinc Nanofertilizer for Rice. *Journal of Soil Science and Plant Nutrition*, **19**(1): 379-389.
- Barita, Y., Prihastanti, E., Haryanti, S., & Subagio, A. 2018. The Influence of Granting NPK Fertilizer and Nanosilic Fertilizers on the Growth of Ganyong Plant (*Canna edulis* Ker.). *Journal of Physics: Conference Series*, **1025**(1): 1-10.
- Baskoro, A. G., Putri, V. A., & Putri, H. A. 2021. Sosialisasi *Microgreen* sebagai Pengenalan Bentuk Budidaya Sayuran *Urban Farming* di Desa Sarirogo Sidoarjo. *JATI EMAS (Jurnal Aplikasi Teknik dan Pengabdian Masyarakat)*, **5**(3): 7-12.
- Bayang, I. A., Rafael, A., & Kase, A. G. 2020. Kandungan Pigmen pada Lamun *Enhalus acoroides* di Perairan Pantai Amadoke Desa Akle Kecamatan Semau Selatan Kabupaten Kupang. *Indigenous Biologi: Jurnal Pendidikan dan Sains Biologi*, **3**(1): 24-31.
- Briat, J. F., Curie, C., & Gaymard, F. 2007. Iron Utilization and Metabolism in Plants. *Current Opinion in Plant Biology*, **10**(3): 276-282.

- Buntoro, B. H., Rogomulyo, R., & Trisnowati, S. 2014. Pengaruh Takaran Pupuk Kandang dan Intensitas Cahaya terhadap Pertumbuhan dan Hasil Temu Putih (*Curcuma zedoaria* L.). *Vegetalika*, **3**(4): 29-39.
- Burhan, A. 2022. Respon Pertumbuhan Tanaman Kangkung Darat (*Ipomoea Reptans* Poir) terhadap Pemberian Pupuk Organik di Lahan Sawah Desa Kelondom. *Jurnal Inovasi Penelitian*, **2**(12): 4211-4218.
- Calabi-Floody, M., Medina, J., Rumpel, C., Condrón, L. M., Hernandez, M., Dumont, M., & Mora, M. D. L. L. 2018. Smart Fertilizers as A Strategy for Sustainable Agriculture. *Advances in Agronomy*, **147**(1): 119-157.
- Chakraborty, R., Mukhopadhyay, A., Paul, S., Sarkar, S., & Mukhopadhyay, R. 2023. Nanocomposite-Based Smart Fertilizers: A Boon to Agricultural and Environmental Sustainability. *Science of The Total Environment*, **863**(1): 1-20.
- Chinnamuthu, C. R. & Boopathi, P. M. 2009. Nanotechnology and Agroecosystem. *Madras Agricultural Journal*, **96**(1): 17-31.
- Clark, J. W., Harris, B. J., Hetherington, A. J., Hurtado-Castano, N., Brench, R. A., Casson, S., Williams, T. A., Gray, J. E., & Hetherington, A. M. 2022. The Origin and Evolution of Stomata. *Current Biology*, **32**(11): 539-553.
- Dewi, N. A. & Mardiana, M. 2023. Pemanfaatan Kangkung Darat (*Ipomoea Reptans* Poir) menjadi Abon Kangkung sebagai Pangan Fungsional di Desa Cipareuan Kabupaten Garut. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, **6**(5): 1710-1716.
- Diana, L., Safitra, A. G., & Ariansyah, M. N. 2020. Analisis Kekuatan Tarik pada Material Komposit dengan Serat Penguat Polimer. *Jurnal Engine: Energi, Manufaktur, dan Material*, **4**(2): 59-67.
- Ealias, A. M. & Saravanakumar, M. P. 2017. A Review on the Classification, Characterisation, Synthesis of Nanoparticles and Their Application. *IOP Conference Series: Materials Science and Engineering*, **263**(3): 1-15.
- Efendi, E., Purba, D. W., & Nasution, N. U. H. 2017. Respon Pemberian Pupuk NPK Mutiara dan Bokashi Jerami Padi terhadap Pertumbuhan dan Produksi Tanaman Bawang Merah (*Allium ascalonicum* L.). *Jurnal Penelitian Pertanian BERNAS*, **13**(3): 20-29.
- El-Kereti, M. A., El-feky, S. A., Khater, M. S., Osman, Y. A., & El-sherbini, E. A. 2013. ZnO Nanofertilizer and He Ne Laser Irradiation for Promoting Growth and Yield of Sweet Basil Plant. *Recent Patents on Food, Nutrition & Agriculture*, **5**(3): 169-181.
- Faizan, M., Hayat, S., & Pichtel, J. 2020. Effects of Zinc Oxide Nanoparticles on Crop Plants: A Perspective Analysis. *Sustainable Agriculture Reviews 41: Nanotechnology for Plant Growth and Development*, **41**(1): 83-99.
- Farida, N., Harmi, J., & Kusmarwiyah, R. 2024. Pertumbuhan dan Hasil Tanaman Kangkung Darat (*Ipomoea reptans* Poirs) pada Beberapa Jarak Tanam dan Pemberian Pupuk Bokashi Kotoran Kambing Dosis yang Berbeda. *Jurnal Silva Samalas*, **7**(1): 17-26.
- Farooqui, A., Tabassum, H., Ahmad, A., Mabood, A., Ahmad, A., & Ahmad, I. Z. 2016. Role of Nanoparticles in Growth and Development of Plants: A Review. *International Journal of Pharma Bio Sciences*, **7**(4): 22-37.

- Fatima, F., Hashim, A., & Anees, S. 2021. Efficacy of Nanoparticles as Nanofertilizer Production: A Review. *Environmental Science and Pollution Research*, **28**(2): 1292-1303.
- Fayza, H. N., Azizah, A., Syahri, A., Fadlurrahman, F., & Arifin, R. S. 2022. Budidaya Penanaman Kangkung Darat dengan Memanfaatkan Pekarangan Rumah. *Prosiding Seminar Nasional Pengabdian Masyarakat LPPM UMJ*, **1**(1): 1-5.
- Feng, C., Lü, S., Gao, C., Wang, X., Xu, X., Bai, X., Gao, N., Liu, M., & Wu, L. 2015. "Smart" Fertilizer with Temperature- and pH-Responsive Behavior via Surface-Initiated Polymerization for Controlled Release of Nutrients. *ACS Sustainable Chemistry & Engineering*, **3**(12), 3157-3166.
- Fitriah & Boe, J. C. 2022. Pembuatan Pupuk dari Tanaman Gamal dan Pengaruhnya terhadap Tanaman Kangkung Darat. *Jumat Pertanian: Jurnal Pengabdian Masyarakat*, **3**(3): 150-155.
- Fleischer, A., O'Neill, M. A., Ehwald, R. 1999. The Pore Size of Non-Graminaceous Plant Cell Walls is Rapidly Decreased by Borate Ester Cross-Linking of the Pectic Polysaccharide Rhamnogalacturonan II. *Plant Physiology*, **121**(3): 829-838.
- Ganetri, I., Essamlali, Y., Amadine, O., Danoun, K., Aboulhrouz, S., & Zahouily, M. 2021. Controlling Factors of Slow or Controlled-Release Fertilizers. *Controlled Release Fertilizers for Sustainable Agriculture*, **1**(1): 111-129.
- Ghafariyan, M. H., Malakouti, M. J., Dadpour, M. R., Stroeve, P., & Mahmoudi, M. 2013. Effects of Magnetite Nanoparticles on Soybean Chlorophyll. *Environmental Science & Technology*, **47**(18): 10645-10652.
- Goswami, P., Yadav, S., & Mathur, J. 2019. Positive and Negative Effects of Nanoparticles on Plants and Their Applications in Agriculture. *Plant Science Today*, **6**(2): 232-242.
- Grotz, N. & Guerinet, M. L. 2006. Molecular Aspects of Cu, Fe and Zn Homeostasis in Plants. *Biochimica et Biophysica Acta (BBA)-Molecular Cell Research*, **1763**(7): 595-608.
- Grusak, M. A., Broadley, M. R., & White, P. J. 2016. Plant Macro-and Micronutrient Minerals. *Encyclopedia of Life Sciences*, **1**(1): 1-6.
- Hafeez, B., Khanif, Y. M., & Saleem, M. 2013. Role of Zinc in Plant Nutrition-A Review. *American Journal of Experimental Agriculture*, **3**(2): 374-391.
- Haider, F. U., Zulfiqar, U., Ain, N. U., Hussain, S., Maqsood, M. F., Ejaz, M., Yong, J. W. H., & Li, Y. 2024) Harnessing Plant Extracts for Eco-Friendly Synthesis of Iron Nanoparticle (Fe-NPs): Characterization and Their Potential Applications for Ameliorating Environmental Pollutants. *Ecotoxicology and Environmental Safety*, **281**(1): 1-17.
- Hänsch, R. & Mendel, R. R. 2009. Physiological Functions of Mineral Micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, Cl). *Current Opinion in Plant Biology*, **12**(3): 259-266.
- Hardin, Azizu, A. M., Anita, Kurniawan, D. R. C., & Rihaana. 2021. Pelatihan Budidaya Kangkung Sistem Hidroponik di Kota Baubau. *Jurnal Pengabdian Kepada Masyarakat Membangun Negeri*, **5**(1): 265-275.
- Haryanti, S. 2010. Jumlah dan Distribusi Stomata pada Daun Beberapa Spesies Tanaman Dikotil dan Monokotil. *Anatomi Fisiologi*, **18**(2): 21-28.

- Hashimoto, H., Uragami, C., & Cogdell, R. J. 2016. Carotenoids and Photosynthesis. *Sub-cellular Biochemistry*, **79**(1): 111–139.
- Hassanpouraghdam, M. B., Mehrabani, L. V., & Tzortzakis, N. 2020. Foliar Application of Nano-Zinc and Iron Affects Physiological Attributes of *Rosmarinus officinalis* and Quietens NaCl Salinity Depression. *Journal of Soil Science and Plant Nutrition*, **20**(1): 335-345.
- Hasyiyati, N. A., Nurmi, N., & Ilahude, Z. 2023. Analisis Kandungan Unsur Hara Mikro (Mn, Fe, Zn), C-Organik dan Kadar Air pada Lahan Jagung (*Zea mays* L.) di Kecamatan Tabongo Kabupaten Gorontalo. *Jurnal Lahan Pertanian Tropis (JLPT)*, **2**(2): 104-109.
- Hidayat, A. N., Mustofa, A., & Cintamulya, I. 2024. Kerapatan Stomata pada Daun Mangga (*Mangifera indica*) di Kawasan PT Semen Gresik Pabrik Tuban Kecamatan Kerek Kabupaten Tuban. *Jurnal Biologi Universitas Andalas*, **12**(2): 73-78.
- Humami, D. W., Sujono, P. A. W., & Desmawati, I. 2020. Densitas dan Morfologi Stomata Daun *Pterocarpus indicus* di Jalan Arif Rahman Hakim dan Kampus ITS, Surabaya. *Rekayasa*, **13**(3): 240-245.
- Hussain, A., Ali, S., Rizwan, M., Rehman, M. Z. U., Javed, M. R., Imran, M., Shahzad, A. S. C., & Nazir, R. 2018. Zinc Oxide Nanoparticles Alter The Wheat Physiological Response and Reduce The Cadmium Uptake by Plants. *Environmental Pollution*, **242**(2): 1518-1526.
- 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.
- Insani, A. N., Nompoo, S., & Natsir, A. 2020. Growth Characteristics of The Corn Crop Planted with Mixed Crop Planting System with *Arachis pintoi*. *IOP Conference Series: Earth and Environmental Science*, **492**(1): 1-5.
- Irwan, A. W. & Wicaksono, F. Y. 2017. Perbandingan Pengukuran Luas Daun Kedelai dengan Metode Gravimetri, Regresi dan Scanner. *Kultivasi*, **16**(3): 425-429.
- Iskandar, A. 2018. Optimalisasi Sekam Padi Bekas Ayam Petelur terhadap Produktivitas Tanaman Kangkung Darat (*Ipomoea reptans*). *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, **1**(3): 245-252.
- ITIS (Integrated Taxonomic Information System). 2011. *Convolvulaceae of North America Update, Database (Version 2011)*. The Flora of North America Expertise Network. <https://www.itis.gov/servlet/SingleRpt/SingleRpt>. [Diakses 6 Maret 2025].
- Jacobs, D. F. & Landis, T. D. 2014. Plant Nutrition and Fertilization. *Tropical Nursery Manual*, **732**(1): 232-251.
- Jadhav, P., Khalid, Z. B., Zularisam, A. W., Krishnan, S., & Nasrullah, M. 2022. The Role of Iron-Based Nanoparticles (Fe-NPs) on Methanogenesis in Anaerobic Digestion (AD) Performance. *Environmental Research*, **204**(1): 1-13.
- Jahangirian, H., Rafiee-Moghaddam, R., Jahangirian, N., Nikpey, B., Jahangirian, S., Bassous, N., Saleh, B., Kalantari, K., & Webster, T. J. 2020. Green Synthesis of Zeolite/Fe₂O₃ Nanocomposites: Toxicity & Cell Proliferation

- Assays and Application as a Smart Iron Nanofertilizer. *International Journal of Nanomedicine*, **15**(1): 1005-1020.
- Jayanti, E. T. 2017. Profil Anatomi Batang Kacang Komak (*Lablab purpureus* (L.) Sweet) Lokal Pulau Lombok. *Biota: Biologi dan Pendidikan Biologi*, **10**(2): 151-164.
- Jindal, A., Bhat, A. H., Raja, V., Ahmad, S. S., Hussain, M. A., Ataya, F. S., & Fouad, D. 2025. Eco-Friendly Synthesis of Zinc Oxide Nanoparticles from *Achillea millefolium*: Multifunctional Applications in Plant Growth and Nematode Control. *Physiological and Molecular Plant Pathology*, **136**(1): 1-17.
- Kalpana, V. N. & Rajeswari, V. D. 2018. A Review on Green Synthesis, Biomedical Applications, and Toxicity Studies of ZnO NPs. *Bioinorganic Chemistry and Applications*, **2018**(1): 1-12.
- Karthik, A. & Maheswari, M. U. 2021. Smart Fertilizer Strategy for Better Crop Production. *Agricultural Reviews*, **42**(1): 12-21.
- Kartini, A. Y. & Robbani, S. 2022. Pemanfaatan Tanaman Kangkung dan Sampah Lingkungan sebagai Upaya Peningkatan Ekonomi Masyarakat Desa Ngumpakdalem di Masa Pandemi Covid 19. *Mafaza: Jurnal Pengabdian Masyarakat*, **2**(1): 69-82.
- Khalofah, A., Ghramh, H. A., Al-Qthanin, R. N., & L'taief, B. 2022. The Impact of NPK Fertilizer on Growth and Nutrient Accumulation in Juniper (*Juniperus procera*) Trees Grown on Fire-Damaged and Intact Soils. *PLoS One*, **17**(1): 1-14.
- Kianfar, E. 2020. Zeolites: Properties, Applications, Modification and Selectivity. *Zeolites: Advances in Research and Applications*, **1**(1): 1-22.
- Kim, S. A. & Guerinot, M. L. 2007. Mining Iron: Iron Uptake and Transport in Plants. *FEBS Letters*, **581**(12): 2273-2280.
- Kobayashi, T. & Nishizawa, N. K. 2012. Iron Uptake, Translocation, and Regulation in Higher Plants. *Annual Review of Plant Biology*, **63**(1): 131-152.
- Kobayashi, T., Nozoye, T., & Nishizawa, N. K. 2019. Iron Transport and Its Regulation in Plants. *Free Radical Biology and Medicine*, **133**(1): 11-20.
- Kopitke, P. M., Lombi, E., Wang, P., Schjoerring, J. K., & Husted, S. 2019. Nanomaterials as Fertilizers for Improving Plant Mineral Nutrition and Environmental Outcomes. *Environmental Science: Nano*, **6**(12): 3513-3524.
- Kresna, I. G. P. D. B., Sukerta, I. M., & Suryana, I. M. 2016. Pertumbuhan dan Hasil Beberapa Varietas Tanaman Kangkung Darat (*Ipomoea reptans* P.) pada Tanah Alluvial Coklat Kelabu. *Agrimeta*, **6**(12): 52-65.
- Kriswantoro, H. K., Safriyani, E., & Bahri, S. 2016. Pemberian Pupuk Organik dan Pupuk NPK pada Tanaman Jagung Manis (*Zea mays saccharata* Sturt). *Klorofil: Jurnal Penelitian Ilmu-Ilmu Pertanian*, **11**(1): 1-6.
- Kuntorini, E. M., Astuti, M. D., & Milina, N. 2018. Struktur Anatomi dan Kerapatan Sel Sekresi serta Aktivitas Antioksidan Ekstrak Etanol dari Rimpang Temulawak (*Curcuma xanthorrhiza* Roxb) Asal Kecamatan Pengaron Kabupaten Banjar Kalimantan Selatan. *Bioscientiae*, **8**(1): 28-37.
- Kurniawan, M. A., Wahyuningrum, I. R., & Anggraini, D. 2018. Sintesis dan Karakterisasi Komposit Alginat/Zeolit/Fe-Zn sebagai Salah Satu Material

- Pupuk Penyimpan Fe dan Zn. *IJCR-Indonesian Journal of Chemical Research*, **3**(1): 31-37.
- Kurniawan, M., Izzati, M., & Nurchayati, Y. 2010. Kandungan Klorofil, Karotenoid, dan Vitamin C pada Beberapa Spesies Tumbuhan Akuatik. *Buletin Anatomi dan Fisiologi*, **18**(1): 28-40.
- Larijani, G., Parivar, K., Roodbari, N. H., Yaghmaei, P., & Amini, N. 2024. Fortified Electrospun Collagen Utilizing Biocompatible Poly Glycerol Sebacate Prepolymer (PGSp) and Zink Oxide Nanoparticles (ZnO NPs) for Diabetics Wound Healing: Physical, Biological and Animal Studies. *Regenerative Therapy*, **26**(1): 102-113.
- Laštovičková, A., Rainer, D. N., & Mazur, M. 2025. Shedding Electrons on ADOR Zeolite Structures—Structure Determination by 3DED. *Microporous and Mesoporous Materials*, **387**(1): 1-10.
- Latef, A. A. H. A., Alhmad, M. F. A., & Abdelfattah, K. E. 2017. The Possible Roles of Priming with ZnO Nanoparticles in Mitigation of Salinity Stress in Lupine (*Lupinus termis*) plants. *Journal of Plant Growth Regulation*, **36**(1): 60-70.
- Lee, K. Y. & Mooney, D. J. 2012. Alginate: Properties and Biomedical Applications. *Progress in Polymer Science*, **37**(1): 106-126.
- Liang, G. 2022. Iron Uptake, Signaling, and Sensing in Plants. *Plant Communications*, **3**(5) 1-13.
- Liu, R. & Lal, R. 2014. Synthetic Apatite Nanoparticles as a Phosphorus Fertilizer for Soybean (*Glycine max*). *Scientific Reports*, **4**(5686): 1-6.
- Mahmoud, A. W. M., Abdelaziz, S. M., El-Mogy, M. M., & Abdeldaym, E. A. 2019. Effect of Foliar ZnO and FeO Nanoparticles Application on Growth and Nutritional Quality of Red Radish and Assessment of Their Accumulation on Human Health. *Agriculture*, **65**(1): 16-29.
- Malka, M., Laing, G. D., Kurešová, G., Hegedüsová, A., & Bohn, T. 2023. Enhanced Accumulation of Phenolics in Pea (*Pisum sativum* L.) Seeds upon Foliar Application of Selenate or Zinc Oxide. *Frontiers in Nutrition*, **10**(1): 1-12.
- Manjunatha, S. B., Biradar, D. P., & Aladakatti, Y. R. 2016. Nanotechnology and Its Applications in Agriculture: A Review. *Journal of Farm Sciences*, **29**(1): 1-13.
- Manuhuttu, A. P., Rehatta, H., & Kailola, J. J. G. 2014. Pengaruh Konsentrasi Pupuk Hayati Bioboost terhadap Peningkatan Produksi Tanaman Selada (*Lactuca sativa* L.). *Agrologia*, **3**(1): 18-27.
- Maoka, T. 2020. Carotenoids as Natural Functional Pigments. *Journal of Natural Medicines*, **74**(1): 1-16.
- Mekki, A., Hachemaoui, M., Mokhtar, A., Issam, I., Bennabi, F., Iqbal, J., Rahmani, K., Bengueddach, A., & Boukoussa, B. 2022. Catalytic Behavior and Antibacterial/Antifungal Activities of New MNPs/Zeolite@Alginate Composite Beads. *International Journal of Biological Macromolecules*, **198**(1): 37-45.
- Milani, N., McLaughlin, M. J., Stacey, S. P., Kirby, J. K., Hettiarachchi, G. M., Beak, D. G., & Cornelis, G. 2012. Dissolution Kinetics of Macronutrient Fertilizers Coated with Manufactured Zinc Oxide Nanoparticles. *Journal of Agricultural and Food Chemistry*, **60**(16): 3991-3998.

- Minarni, M., Asyhar, R., Amandanisa, A., Ainun, S., Yudha, Y. S., Artika, I. M., & Nurcholis, W. 2023. Effect of Combined NPK Fertilizer on Polyphenol Contents and Antioxidant Activity in Methanol Extract of *Curcuma xanthorrhiza*. *Journal of Applied Biology & Biotechnology*, **11**(6): 66-73.
- Miskoska-Milevska, E., Dimovska, D., Popovski, Z. T., & Iljovski, I. 2020. Influence of the Fertilizers Slavol and Biohumus on Potato Leaf Area and Stomatal Density. *Acta Agriculturae Serbica*, **25**(49): 13–17.
- Mohsin, M. Z., Huang, J., Hussain, M. H., Zaman, W. Q., Liu, Z., Zhuang, Y., Guo, M., & Mohsin, A. 2023. Revolutionizing Bioremediation: Advances in Zeolite-Based Nanocomposites. *Coordination Chemistry Reviews*, **491**(1): 1-25.
- Mondal, A., Dey, I., Mukherjee, A., Ismail, A., Satpati, G. G., Banerjee, S., Paul, S., Paul, S., & Pal, R. 2024. Spirulina Biomass Loaded with Iron Nanoparticles: A Novel Biofertilizer for The Growth and Enrichment of Iron Content in Rice Plants. *Biocatalysis and Agricultural Biotechnology*, **61**(1): 1-13.
- Muthia, R., Kartini, Jamaludin, W. B., & Damayanti, L. 2023. Karakterisasi dan Penetapan Kadar Fenol Total Ekstrak Etanol Umbi Bawang Dayak (*Eleutherine bulbosa* Urb.) berdasarkan Variasi Waktu Tumbuh Tanaman. *Jurnal Ilmiah Farmasi*, **1**(1): 83-93.
- Natasha, N., Shahid, M., Bibi, I., Iqbal, J., Khalid, S., Murtaza, B., Bakhat, H. F., Farooq, A. B. U., Amjad, M., Hammad, H. M., Niazi, N. K., & Arshad, M. 2022. Zinc in Soil-Plant-Human System: A Data-Analysis Review. *Science of The Total Environment*, **808**(1): 1-13.
- Nilasari, A. N., Heddy, J. S., & Wardiyati, T. 2013. Identifikasi Keragaman Morfologi Daun Mangga (*Mangifera indica* L.) pada Tanaman Hasil Persilangan antara Varietas Arumanis 143 dengan Podang Urang Umur 2 Tahun. *Jurnal Produksi Tanaman*, **1**(1): 61-69.
- Ningsih, M. S., Susilo, E., Rahmadina, R., Qolby, F. H., Tanjung, D. D., Anis, U., Susila, E., Panggabean, N. H., Priyadi, S., Nasution, J., Sari, N. Y., Baharuddin, R., & Wisnubroto, M. P. 2024. *Dasar-Dasar Fisiologi Tumbuhan*. CV Hei Publishing Indonesia. Padang.
- Njogu, R. E. N., Kariuki, D. K., Kamau, D. M., & Wachira, F. N. 2014. Relationship between Tea (*Camellia sinensis*) Leaf Uptake of Major Nutrients, Nitrogen, Phosphorous and Potassium (NPK) and Leaf Anatomy of Different Varieties Grown in the Kenyan Highlands. *BEST: International Journal of Humanities, Arts, Medicine and Sciences*, **2**(8): 95-102.
- Nugroho, S. A., Taufika, R., & Novenda, I. L. 2020. Analisis Kandungan Asam Askorbat pada Tanaman Kangkung (*Ipomoea reptans* Poir), Bayam (*Amaranthus spinosus*), dan Ketimun (*Cucumis sativus* L). *Jurnal Tambora*, **4**(1): 26-31.
- Nurhidayati, Basit, A., Tito, S. I., & Rahmawati, N. U. S. 2023. *Peluang dan Prospek Teknologi Nano dalam Sistem Produksi Pertanian di Indonesia*. Unisma Press. Malang.
- Nurmala, T., Septian, F. I., Wahyudin, A., & Wicaksono, F. Y. 2023. Effect of NPK Fertilizer Dose and GA3 Concentration on Growth, Yield, and Yield Quality of *Coix lacryma-jobi* L. Var. *Ma-yuen* from Ratoons. *Jurnal Kultivasi*, **22**(1): 101-107.

- Nurza, I. S. A. 2022. Cultivation of Water Spinach (*Ipomoea reptans* Poir) Production by Using DFT and NFT. *Journal of Social Research*, **1**(10): 1110-1115.
- Oka, A. A. 2007. Pengaruh Pemberian Pupuk Kascing terhadap Pertumbuhan Tanaman Kangkung Darat (*Ipomoea reptans* Poir). *Jurnal Sains MIPA*, **13**(1): 26-28.
- Palchoudhury, S., Jungjohann, K. L., Weerasena, L., Arabshahi, A., Gharge, U., Albattah, A., Miller, J., Patel, K., & Holler, R. A. 2018. Enhanced Legume Root Growth with Pre-Soaking in α -Fe₂O₃ Nanoparticle Fertilizer. *RSC Advances*, **8**(43): 24075-24083.
- Pérez-Hernández, H., Juárez-Maldonado, A., & Fernández-Luqueño, F. 2025. A Holistic Approach for The Evaluation of Iron Nanoparticles on Maize Plants and Earthworms in Natural Soil. *Chemosphere*, **372**(1): 1-11.
- Perkasa, A. Y., Siswanto, T., Shintarika, F., & Aji, T. G. 2017. Studi Identifikasi Stomata pada Kelompok Tanaman C3, C4 dan CAM. *Jurnal Pertanian Presisi*, **1**(1): 59-72.
- Petrov, I. & Michalev, T. 2012. Synthesis of Zeolite A: A Review. *НАУЧНИ ТРУДОВЕ НА РУСЕНСКИЯ УНИВЕРСИТЕТ*, **51**(9): 30-35.
- Pramanik, P., Krishnan, P., Maity, A., Mridha, N., Mukherjee, A., & Rai, V. 2020. Application of Nanotechnology in Agriculture. *Environmental Nanotechnology*, **4**(1): 317-348.
- Prasad, T. N. V. K. V., Sudhakar, P., Sreenivasulu, Y., Latha, P., Munaswamy, V., Reddy, K. R., Sreepasad, T. S., Sajanlal, P. R., & Pradeep, T. 2012. Effect of Nanoscale Zinc Oxide Particles on The Germination, Growth and Yield of Peanut. *Journal of Plant Nutrition*, **35**(6): 905-927.
- Pratama, M. S. & Mustakim, A. 2025. Struktur Sel dan Potensi Regeneratif pada Tumbuhan Jahe (*Zingiber officinale*): Kajian Morfologi, Anatomi, dan Eksplorasi Seluler. *Jurnal Ilmiah Multidisiplin Terpadu*, **9**(1): 371-376.
- Raimondi, G., Maucieri, C., Toffanin, A., Renella, G., & Borin, M. 2021. Smart Fertilizers: What Should We Mean and Where Should We Go?. *Italian Journal of Agronomy*, **16**(2) 1-22.
- Raliya, R. & Tarafdar, J. C. 2013. ZnO Nanoparticle Biosynthesis and Its Effect on Phosphorous-Mobilizing Enzyme Secretion and Gum Contents in Clusterbean (*Cyamopsis tetragonoloba* L.). *Agricultural Research*, **2**(1): 48-57.
- Raus, R. A., Nawawi, W. M. F. W., & Nasaruddin, R. R. 2021. Alginate and Alginate Composites for Biomedical Applications. *Asian Journal of Pharmaceutical Sciences*, **16**(3): 280-306.
- Rehman, H., Aziz, T., Farooq, M., Wakeel, A., & Rengel, Z. 2012. Zinc Nutrition in Rice Production Systems: A Review. *Plant Soil*, **361**(1): 203-226.
- Rico, C. M., Majumdar, S., Duarte-Gardea, M., Peralta-Videa, J. R., & Gardea-Torresdey, J. L. 2011. Interaction of Nanoparticles with Edible Plants and Their Possible Implications in the Food Chain. *Journal of Agricultural and Food Chemistry*, **59**(8): 3485-3498.
- Rizwan, M., Ali, S., Ali, B., Adrees, M., Arshad, M., Hussain, A., Rehman, M. Z. U., & Waris, A. A. 2019. Zinc and Iron Oxide Nanoparticles Improved the Plant Growth and Reduced the Oxidative Stress and Cadmium Concentration in Wheat. *Chemosphere*, **214**(1): 269-277.

- Römheld, V. & Marschner, H. 1991. Function of Micronutrients in Plants. *Micronutrients in Agriculture*, **2**(4): 297-328.
- Roschztardt, H., Conéjéro, G., Divol, F., Alcon, C., Verdeil, J. L., Curie, C., & Mari, S. 2013. New Insights into Fe Localization in Plant Tissues. *Frontiers in Plant Science*, **4**(350): 1-11.
- Rosdayanti, H., Siregar, U. J., & Siregar, I. 2019. Karakter Penciri Morfologi Daun Meranti (*Shorea* spp.) pada Area Budidaya *Ex-Situ* KHDTK Haurbentes. *Media Konservasi*, **24**(2): 207-215.
- Rout, G. R. & Sahoo, S. 2015. Role of Iron in Plant Growth and Metabolism. *Reviews in Agricultural Science*, **3**(1): 1-24.
- Rudani, K., Vishal, P., & Kalavati, P. 2018. The Importance of Zinc in Plant Growth-A Review. *International Research Journal of Natural and Applied Sciences*, **5**(2): 38-48.
- Sadeghzadeh, B. 2013. A Review of Zinc Nutrition and Plant Breeding. *Journal of Soil Science and Plant Nutrition*, **13**(4): 905-927.
- Sam, S., Malik, A., & Handayani, S. 2016. Penetapan Kadar Fenolik Total dari Ekstrak Etanol Bunga Rosella Berwarna Merah (*Hibiscus sabdariffa* L.) dengan Menggunakan Spektrofotometri UV-Vis. *Jurnal Fitofarmaka Indonesia*, **3**(2): 182-187.
- Sari, E. K. & Hidayati, S. 2020. Penetapan Kadar Klorofil dan Karotenoid Daun Sawi (*Brassica*) Menggunakan Metode Spektrofotometri UV-Vis. *Fullerene Journal of Chemistry*, **5**(1): 49-52.
- Sarkar, R. K., Jana, J. C., & Datta, S. 2014. Effect of Cutting Frequencies and Nitrogen Levels on Growth, Green and Seed Yield and Quality of Water Spinach (*Ipomoea reptans* Poir.). *Journal of Applied and Natural Science*, **6**(2): 545-551.
- Sarwar, M., Patra, J. K., Ali, A., Maqbool, M., & Arshad, M. I. 2020. Effect of Compost and NPK Fertilizer on Improving Biochemical and Antioxidant Properties of *Moringa oleifera*. *South African Journal of Botany*, **129**(1): 62-66.
- Savci, S. 2012. Investigation of Effect of Chemical Fertilizers on Environment. *APCBEE Procedia*, **1**(1): 287-292.
- Sengul, M., Yildiz, H., Gungor, N., Cetin, B., Eser, Z., & Ercisli, S. 2009. Total Phenolic Content, Antioxidant and Antimicrobial Activities of Some Medicinal Plants. *Pakistan Journal of Pharmaceutical Sciences*, **22**(1): 102-106.
- Shah, P., Awasthi, H., Kunwar, K., & Kalauni, S. K. 2021. Phytochemical Analysis and Antioxidant Activity of *Ipomoea aquatica* from Ghodaghodi Wet Land Area, Nepal. *International Journal of Herbal Medicine*, **9**(2): 23-27.
- Shahidi, F., Janitha, P. K., & Wanasundara, P. D. 1992. Phenolic Antioxidants. *Critical Reviews in Food Science & Nutrition*, **32**(1): 67-103.
- Shanmugavel, D., Rusyn, I., Solorza-Feria, O., & Kamaraj, S. K. 2023. Sustainable SMART Fertilizers in Agriculture Systems: A Review on Fundamentals to in-Field Applications. *Science of The Total Environment*, **904**(1): 1-26.

- Sharma, A. & Chetani, R. 2017. A Review on The Effect of Organic and Chemical Fertilizers on Plants. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, **5**(2): 677-680.
- Sharma, C. P. 2006. *Plant Micronutrients 1st Edition*. CRC Press. Boca Raton.
- Sinulingga, E. S. R., Ginting, J., & Sabrina, T. 2015. Pengaruh Pemberian Pupuk Hayati Cair dan Pupuk NPK terhadap Pertumbuhan Bibit Kelapa Sawit di *Pre Nursery*. *Jurnal Online Agroekoteknologi*, **3**(3): 1219-1225.
- Sion, R., Agustiansyah, A., & Timotiwi, P. B. 2024. Pengaruh Nutripriming pada Benih dengan Zinc (Zn) terhadap Pertumbuhan Vegetatif Tanaman Jagung Ungu Hibrida. *Jurnal Agrotek Tropika*, **12**(1): 189-197.
- Siswoyo, E. & Hermana, J. 2017. Pengaruh Air Limbah Industri Tahu terhadap Laju Pertumbuhan Tanaman Bayam Cabut (*Amaranthus tricolor*). *Jurnal Sains & Teknologi Lingkungan*, **9**(2): 105-113.
- Sofiyanti, N., Iriani, D., & Lestari, A. R. 2022. Kajian Anatomi-Histokimia Tangkai Daun dan Karakteristik Epidermis Pucuk Merah (*Syzygium myrtifolium* Walp. - Myrtaceae). *Buletin Anatomi dan Fisiologi*, **7**(2): 83-90.
- Solanki, P., Bhargava, A., Chhipa, H., Jain, N., & Panwar, J. 2015. Nano-Fertilizers and Their Smart Delivery System. *Nanotechnologies in Food and Agriculture*, **1**(1): 81-101.
- Srivastava, R. 2022. Sustainable Food Production through Climate Resilient Crop: A Case Study of Water Spinach (*Ipomoea aquatica*). *Climate Change and Environmental Sustainability*, **10**(2): 132-141.
- Sturikova, H., Krystofova, O., Huska, D., & Adam, V. 2018. Zinc, Zinc Nanoparticles and Plants. *Journal of Hazardous Materials*, **349**(1): 101-110.
- Sunardi, O., Adimihardja, S. A., & Mulyaningsih, Y. 2013. Pengaruh Tingkat Pemberian ZPT Gibberellin (GA3) terhadap Pertumbuhan Vegetatif Tanaman Kangkung Air (*Ipomoea aquatica* Forsk L.) pada Sistem Hidroponik *Floating Raft Technique* (FRT). *Jurnal Pertanian*, **4**(1): 33-47.
- Sunarjono, H. & Nurrohmah, F. A. 2018. *Bertanam Sayuran Daun & Umbi*. Penebar Swadaya. Jakarta Timur.
- Susanto, H. & Gunawan, A. 2021. *Buku Panduan Bertani Kangkung darat Cerdas dan Organik Melalui Teknologi Cerdas dan Sistem Organik Terintegrasi*. Guepedia. Bogor.
- Sushardi, Woosono, H. B., & Hadi, D. S. 2022. Keragaman Sifat Anatomi Kayu Sengon dan Kemungkinan Penggunaannya sebagai Bahan Furniture. *Jurnal Wana Tropika*, **12**(2): 70-79.
- Sutan, S. M., Prasetyo, J., & Mahbudi, I. 2018. Pengaruh Paparan Frekuensi Gelombang Bunyi terhadap Fase Vegetatif Pertumbuhan Tanaman Kangkung Darat (*Ipomoea reptans* Poir). *Jurnal Keteknik Pertanian Tropis dan Biosistem*, **6**(1): 72-78.
- Sutharsan, S. & Rajendran, M. 2018. Effects of Different Levels of Nitrogen Sources and Spacing on Growth and Yield of Tomato (*Lycopersicon esculentum* Mill) var. Thilina. *International Journal of Research Publications*, **8**(1): 1-7.
- Tanaka, Y., Sugano, S. S., Shimada, T., & Hara-Nishimura, I. 2013. Enhancement of Leaf Photosynthetic Capacity through Increased Stomatal Density in *Arabidopsis*. *New Phytologist*, **198**(3): 757-764.

- Tayade, R., Ghimire, A., Khan, W., Lay, L., Attipoe, J. Q., & Kim, Y. 2022. Silicon as A Smart Fertilizer for Sustainability and Crop Improvement. *Biomolecules*, **12**(8), 1-17.
- Telaumbanua, P. H., Nazara, R. V., Zebua, H. P., Bachtiar, Samudin, S., Monde, A., Purba, J. H., Sulistiyowati, R., Harti, A. O. R., Telaumbanua, E. D., Susyowati, Kartini, N. L., & Mendrofa, P. K. T. 2024. *Dasar-dasar Agronomi*. Azzia Karya Bersama. Padang.
- Timba, F. N. S., Satu, E. P., Tandi, A. M. J., Sa, M. Y., Stefanus, M., Niri, D. K., Seran, M. S. P., Oris, R., Rian, Y. N., Bela, S. L. S., & Vika, Y. L. 2024. Optimalisasi Tanaman Sayur Sawi dan Kangkung dengan Program P2L sebagai Upaya Penurunan Angka Stunting di Desa Bokang Wolomatang, Kecamatan Titehena, Flores Timur. *Community Development Journal: Jurnal Pengabdian Masyarakat*, **5**(5): 9336-9343.
- Trenggono, A., Herbirowo, S., Milandia, A., & Sudrajat, A. 2014. Sintesis dan Karakterisasi Epoksi Nanokomposit Berpenguat Fe-Ni Nanopartikel dengan Variasi Fraksi Berat serta Waktu Sonikasi. *Teknika: Jurnal Sains dan Teknologi*, **10**(2): 185-191.
- Trenkel, M. E. 2021. *Slow-and Controlled-Release and Stabilized Fertilizers: An Option for Enhancing Nutrient Use Efficiency in Agriculture*. International Fertilizer Industry Association (IFA). Paris.
- Tsonev, T. & Lidon, F. J. C. 2012. Zinc in Plants-An Overview. *Emirates Journal of Food & Agriculture (EJFA)*, **24**(4): 322-333.
- Umam, C., Putri, S. A., Milyani, J., Aurelita, S. K., Suryawati, S., & Purwaningsih, Y. 2023. Perhitungan Luas Daun Berbasis Pemrosesan Citra Digital. *Teknotan: Jurnal Industri Teknologi Pertanian*, **17**(2): 115-122.
- Umesha, C., Sridhara, C. J., & Kumarnaik, A. H. 2017. Recent Forms of Fertilizers and Their Use to Improve Nutrient Use Efficiency and to Minimize Environmental Impacts. *International Journal of Pure & Applied Bioscience*, **5**(2): 858-63.
- Usman, M., Farooq, M., Wakeel, A., Nawaz, A., Cheema, S. A., Rehman, H. U., Ashraf, I., & Sanaullah, M. 2020. Nanotechnology in Agriculture: Current Status, Challenges and Future Opportunities. *Science of the Total Environment*, **721**(1): 1-16.
- Usman, M., Madu, V. U., & Alkali, G. 2015. The Combined Use of Organic and Inorganic Fertilizers for Improving Maize Crop Productivity in Nigeria. *International Journal of Scientific and Research Publications*, **5**(10): 1-7.
- Wairich, A., Aung, M. S., Ricachenevsky, F. K., & Masuda, H. 2024. You Can't Always Get as Much Iron as You Want: How Rice Plants Deal with Excess of An Essential Nutrient. *Frontiers in Plant Science*, **15**(1): 1-14.
- Wang, Q., Xu, S., Zhong, L., Zhao, X., & Wang, L. 2023. Effects of Zinc Oxide Nanoparticles on Growth, Development, and Flavonoid Synthesis in *Ginkgo biloba*. *International Journal of Molecular Sciences*, **24**(21): 1-14.
- Welch, R. M. & Shuman, L. 1995. Micronutrient Nutrition of Plants. *Critical Reviews in Plant Sciences*, **14**(1): 49-82.
- Wettstein, D. V., Gough, S., & Kannangara, G. 1995. Chlorophyll Biosynthesis. *The Plant Cell*, **7**(1): 1039-1057.
- Winahyu, D. A., Retnaningsih, A., & Saraswati, T. 2018. Penetapan Kadar Besi (Fe) pada Daun Tapak Liman (*Elephantopus scaber* L.) sebagai Obat

- Tradisional Anemia dengan Metode Spektrofotometri Serapan Stom. *Jurnal Analisis Farmasi*, **3**(3): 186-192.
- Xu, Z., Jiang, Y., Jia, B., & Zhou, G. 2016. Elevated-CO₂ Response of Stomata and Its Dependence on Environmental Factors. *Frontiers in Plant Science*, **7**(657): 1-15.
- Xu, Z. & Zhou, G. 2008. Responses of Leaf Stomatal Density to Water Status and Its Relationship with Photosynthesis in a Grass. *Journal of Experimental Botany*, **59**(12): 3317-3325.
- Yadav, A., Babu, S., Krishnan, P., Kaur, B., Bana, R. S., Chakraborty, D., Kumar, V., Joshi, B., & Lal, S. K. 2024. Zinc Oxide and Ferric Oxide Nanoparticles Combination Increase Plant Growth, Yield, and Quality of Soybean under Semiarid Region. *Chemosphere*, **352**(1): 1-11.
- Zannah, H., Evie, R., Sudarti, S., & Trapsilo, P. 2023. Peran Cahaya Matahari dalam Proses Fotosintesis Tumbuhan. *CERMIN: Jurnal Penelitian*, **7**(1): 204-214.
- Zeb, A. 2020. Concept, Mechanism, and Applications of Phenolic Antioxidants in Foods. *Journal of Food Biochemistry*, **44**(9): 1-22.
- Zuhaida, L., Ambarwati, E., & Sulistyaningsih, E. 2012. Pertumbuhan dan Hasil Selada (*Lactuca sativa* L.) Hidroponik Diperkaya Fe. *Vegetalika*, **1**(4): 68-77.