

DAFTAR PUSTAKA

- Abualia, R., Antonielli, L., Montesinos, J. C., Zhang, Y., Tan, S., Cuesta, C., Artner, C., Bouguyon, E., Gojon, A., Friml, J., Guti, R. A., Wabnik, K., & Benkov, E. (2021). *Modulation of plant root growth by nitrogen source-defined regulation of polar auxin transport*. 1–21. <https://doi.org/10.15252/embj.2020106862>
- Adesodun, J. K., Olowokere, F. A., Ismail, A. O., Adekunle, A. O., & Osore, J. A. (2015). Transmission and storage properties of a tropical loamy sand soil as influenced by organic-based and inorganic fertilizers. *Acta Agriculturae Scandinavica Section B: Soil and Plant Science*, 65(1), 14–22. <https://doi.org/10.1080/09064710.2014.959555>
- Afandi, F. N., Siswanto, B., & Nuraini, Y. (2015). Pengaruh Pemberian Berbagai Jenis Bahan Organik Terhadap Sifat Kimia Tanah Pada Pertumbuhan Dan Produksi Tanaman Ubi Jalar Di Entisol Ngrangkah Pawon, Kediri. *Jurnal Tanah Dan Sumberdaya Lahan*, 2(2), 237–244. <http://jtsl.ub.ac.id>
- Agung M, G. F., Hanafie Sy, M. R., & Mardina, P. (2013). Ekstraksi Silika Dari Abu Sekam Padi Dengan Pelarut Koh. *Konversi*, 2(1), 28. <https://doi.org/10.20527/k.v2i1.125>
- Agustian, A. (2014). Pembentukan Asam Humat Dan Fulvat Selama Pembuatan Kompos Jerami Padi. *Jurnal Solum*, 1(1), 9. <https://doi.org/10.25077/js.1.1.9-14.2004>
- Alam, S., Sunaminto, B. H., & Siradz, S. A. (2012). Karakteristik Bahan Induk Tanah Dari Formasi Geologi Kompleks Ultramafik di Sulawesi Tenggara (Characteristics of Soil Parent Materials Complex Ultramafic Geological Formations in Southeast Sulawesi. *Agroteknos*, 2(2), 112–120.
- Ali, M., & Mindari, W. (2016). Effect of humic acid on soil chemical and physical characteristics of embankment. *MATEC Web of Conferences*, 58. <https://doi.org/10.1051/matecconf/20165801028>
- Almeida, C. C., Fontes, M. P. F., Dias, A. C., Pereira, T. T. C., & Ker, J. C. (2021). Mineralogical, chemical and electrochemical attributes of soils. *Scientia Agricola*, 78(6), 1–11. <https://doi.org/10.1590/1678-992x-2020-0071>
- Alsaeedi, A., El-Ramady, H., Alshaal, T., El-Garawany, M., Elhawat, N., & Al-Otaibi, A. (2019). Silica nanoparticles boost growth and productivity of cucumber under water deficit and salinity stresses by balancing nutrients uptake. *Plant Physiology and Biochemistry*, 139, 1–10. <https://doi.org/10.1016/j.plaphy.2019.03.008>
- Amoah-Antwi, C., Kwiatkowska-Malina, J., Szara, E., Fenton, O., Thornton, S. F., & Malina, G. (2022). Assessing Factors Controlling Structural Changes of Humic Acids in Soils Amended with Organic Materials to Improve Soil Functionality. *Agronomy*, 12(2), 1–17. <https://doi.org/10.3390/agronomy12020283>
- Ampong, K., Thilakarathna, M. S., & Gorim, L. Y. (2022). Understanding the Role of Humic Acids on Crop Performance and Soil Health. *Frontiers in*

- Agronomy*, 4(March). <https://doi.org/10.3389/fagro.2022.848621>
- Azat, S., Korobeinyk, A. V., Moustakas, K., & Inglezakis, V. J. (2019). Sustainable production of pure silica from rice husk waste in Kazakhstan. *Journal of Cleaner Production*, 217, 352–359. <https://doi.org/10.1016/j.jclepro.2019.01.142>
- Badan Standarisasi Instrumen Pertanian. (2023). Analisis Kimia Tanah, Tanaman, Air, Dan Pupuk. In *Petunjuk Teknis Edisi*. <https://tanahpupuk.bsip.pertanian.go.id>
- Baigorri, R., Fuentes, M., González-Gaitano, G., García-Mina, J. M., Almendros, G., & González-Vila, F. J. (2009). Complementary Multianalytical Approach To Study the Distinctive Structural Features of the Main Humic Fractions in Solution: Gray Humic Acid, Brown Humic Acid, and Fulvic Acid. *Journal of Agricultural and Food Chemistry*, 57(8), 3266–3272. <https://doi.org/10.1021/jf8035353>
- Barrow, N. J., & Hartemink, A. E. (2023). The effects of pH on nutrient availability depend on both soils and plants. *Plant and Soil*, 487(1–2), 21–37. <https://doi.org/10.1007/s11104-023-05960-5>
- Belton, D. J., Deschaume, O., & Perry, C. C. (2012). An overview of the fundamentals of the chemistry of silica with relevance to biosilicification and technological advances. *The FEBS Journal*, 279(10), 1710–1720. <https://doi.org/10.1111/j.1742-4658.2012.08531.x>
- Bhatt, P., & Singh, V. K. (2022). Effect of humic acid on soil properties and crop production—A review. *The Indian Journal of Agricultural Sciences*, 92(12). <https://doi.org/10.56093/ijas.v92i12.124948>
- BPS. (2018). *Luas Lahan Sawah Menurut Jenis Pengairan 2018*. <https://sidoarjokab.bps.go.id/statictable/2019/10/10/96/luas-lahan-sawah-menurut-jenis-pengairan-2018.html>
- BPS. (2020). *Statistik Daerah Kabupaten Sidoarjo 2020*. 7823–7830.
- BPS. (2023a). *Jumlah Perusahaan Industri Besar dan Industri Sedang Menurut Kecamatan 2018*. <https://sidoarjokab.bps.go.id/statictable/2019/10/10/119/jumlah-perusahaan-industri-besar-dan-industri-sedang-menurut-kecamatan-2018.html>
- BPS. (2023b). *Kabupaten Sidoarjo Dalam Angka 2023*.
- Brownrigg, S., McLaughlin, M. J., McBeath, T., & Vadakattu, G. (2022). Effect of acidifying amendments on P availability in calcareous soils. *Nutrient Cycling in Agroecosystems*, 124(2), 247–262. <https://doi.org/10.1007/s10705-022-10241-1>
- Chakim, M. G., Mindari, W., & Widjajani, B. W. (2022). The potential of organomineral amendments in increasing the adsorption of lead (Pb) and cadmium (Cd) in a sandy loam soil. *Journal of Degraded and Mining Lands Management*, 9(4), 3753–3762. <https://doi.org/10.15243/JDMLM.2022.094.3753>
- Chaudhry, S., & Garg, S. (2019). *Industrial Wastewater Pollution and Advanced*

- Treatment Techniques* (pp. 74–97). <https://doi.org/10.4018/978-1-5225-5754-8.ch006>
- Connell, D. W., & Miller, G. J. (1984). Chemistry and ecotoxicology of pollution / Des W. Connell, Gregory J. Miller. *Environmental Science and Technology*. https://books.google.com/books/about/Chemistry_and_Ecotoxicology_of_Pollution.html?hl=id&id=JkxDTy9K8p4C
- de Melo, B. A. G., Motta, F. L., & Santana, M. H. A. (2016). Humic acids: Structural properties and multiple functionalities for novel technological developments. *Materials Science and Engineering: C*, 62, 967–974. <https://doi.org/10.1016/j.msec.2015.12.001>
- Debicka, M. (2024). *The Role of Organic Matter in Phosphorus Retention in Eutrophic and Dystrophic Terrestrial Ecosystems*.
- Dhage, S., Patil, V. D., & Dhamak, A. L. (2014). Influence of phosphorus and sulphur levels on nodulation, growth parameters and yield of soybean (*Glycine max* L.) grown on Vertisol. *AN ASIAN JOURNAL OF SOIL SCIENCE*, 9(2), 244–249. <https://doi.org/10.15740/HAS/AJSS/9.2/244-249>
- Diaco, M., & Montemurro, F. (2011). Long-Term Effects of Organic Amendments on Soil Fertility. In *Sustainable Agriculture Volume 2* (pp. 761–786). Springer Netherlands. https://doi.org/10.1007/978-94-007-0394-0_34
- Economou-Eliopoulos, M., & Megremi, I. (2021). Contamination of the Soil-Groundwater-Crop System: Environmental Risk and Opportunities. *Minerals*, 11(7). <https://doi.org/10.3390/MIN11070775>
- El-Ramady, H., Alshaal, T., Elhawat, N., Ghazi, A., Elsakhawy, T., Omara, A. E. D., El-Nahrawy, S., Elmahrouk, M., Abdalla, N., Domokos-Szabolcsy, É., & Schnug, E. (2018). Plant nutrients and their roles under saline soil conditions. *Plant Nutrients and Abiotic Stress Tolerance*, 297–324. https://doi.org/10.1007/978-981-10-9044-8_13_COVER
- Eshwar, M., Srilatha, M., Rekha, K. B., & Sharma, S. H. K. (2017). Characterization of Humic Substances by Functional Groups and Spectroscopic Methods. *International Journal of Current Microbiology and Applied Sciences*, 6(10), 1768–1774. <https://doi.org/10.20546/ijcmas.2017.610.213>
- Fang, Q., Ma, Y., Zhang, X., Wei, S., & Hou, Y. (2020). Mitigating Nitrogen Emissions From Dairy Farming Systems in China. *Frontiers in Sustainable Food Systems*, 4(May), 1–12. <https://doi.org/10.3389/fsufs.2020.00044>
- Feng, J., Haruna Ahmed, O., Boyie Jalloh, M., Omar, L., Min Kwan, Y., Alhassan Musah, A., & Heong Poong, K. (2022). Soil Nutrient Retention and pH Buffering Capacity Are Enhanced by Calciprill and Sodium Silicate. *Agronomy*, 12(1), 1–24. <https://doi.org/10.3390/agronomy12010219>
- Fernando, D. R., & Lynch, J. P. (2015). Manganese phytotoxicity: New light on an old problem. *Annals of Botany*, 116(3), 313–319. <https://doi.org/10.1093/aob/mcv111>
- Firda; Mulyani, O., & Yuniarti, A. (2016). *Pembentukan, Karakterisasi Serta*

- Manfaat Asam Humat Terhadap Adsorbsi Logam Berat (Review).* 14(2), 9–13.
- Franklin, O., Cambui, C. A., Gruffman, L., Palmroth, S., Oren, R., & Näsholm, T. (2017). The carbon bonus of organic nitrogen enhances nitrogen use efficiency of plants. *Plant Cell and Environment*, 40(1), 25–35. <https://doi.org/10.1111/pce.12772>
- Franklin, S. B., Young, M. B., & Ciacciariello, M. (2022). The Impact of Different Sources of Zinc, Manganese, and Copper on Broiler Performance and Excreta Output. *Animals*, 12(9). <https://doi.org/10.3390/ani12091067>
- Ganjegunte, G., Ulery, A., Niu, G., & Wu, Y. (2018). Treated urban wastewater irrigation effects on bioenergy sorghum biomass, quality, and soil salinity in an arid environment. *Land Degradation & Development*, 29(3), 534–542. <https://doi.org/10.1002/lde.2883>
- Garnit, H., Kraemer, D., Bouhlel, S., Davoli, M., & Barca, D. (2020). Manganese ores in Tunisia: Genetic constraints from trace element geochemistry and mineralogy. *Ore Geology Reviews*, 120(February), 103451. <https://doi.org/10.1016/j.oregeorev.2020.103451>
- Gómez-Acata, E. S., Valencia-Becerril, I., Valenzuela-Encinas, C., Velásquez-Rodríguez, A. S., Navarro-Noya, Y. E., Montoya-Ciriaco, N., Suárez-Arriaga, M. C., Rojas-Valdez, A., Reyes-Reyes, B. G., Luna-Guido, M., & Dendooven, L. (2016). Deforestation and Cultivation with Maize (*Zea mays* L.) has a Profound Effect on the Bacterial Community Structure in Soil. *Land Degradation & Development*, 27(4), 1122–1130. <https://doi.org/10.1002/lde.2328>
- Gonc, G., Gunes, A., Akca, H., & Taskin, M. B. (2024). Green Synthesis of Biogenic Nano-Silicon From Rice Husk and Its Effect on Combined Boron and Salinity Stress Tolerance of Barley and Wheat. *Journal of Soil Science and Plant Nutrition*, 24(1), 252–262. <https://doi.org/10.1007/s42729-023-01577-w>
- Gümü, İ., & Şeker, C. (2015). *Influence of humic acid applications on soil physicochemical properties: Vol. Vol 7.* Solid Earth Discussions.
- Hardyanti, I. S., Nurani, I., Hardjono HP, D. S., Apriliani, E., & Wibowo, E. A. P. (2017). Pemanfaatan Silika (SiO₂) dan Bentonit sebagai Adsorben Logam Berat Fe pada Limbah Batik. *JST (Jurnal Sains Terapan)*, 3(2). <https://doi.org/10.32487/jst.v3i2.257>
- Hartemink, A. E., & Barrow, N. J. (2023). Soil pH - nutrient relationships: the diagram. *Plant and Soil*, 486(1–2), 209–215. <https://doi.org/10.1007/s11104-022-05861-z>
- Jiang, Y., Zhao, J., & Zhang, D. (2024). Manganese Dioxide-Based Nanomaterials for Medical Applications. *ACS Biomaterials Science & Engineering*, 10(5), 2680–2702. <https://doi.org/10.1021/acsbiomaterials.3c01852>
- Joimel, S., Cortet, J., Jolivet, C. C., Saby, N. P. A., Chenot, E. D., Branchu, P., Consalès, J. N., Lefort, C., Morel, J. L., & Schwartz, C. (2016). Physico-

- chemical characteristics of topsoil for contrasted forest, agricultural, urban and industrial land uses in France. *Science of the Total Environment*, 545–546, 40–47. <https://doi.org/10.1016/j.scitotenv.2015.12.035>
- Kalbuadi, D. N., Santi, L. P., Goenadi, D. H., & Barus, J. (2020). Application of bio-silicic acid to improve yield and fertilizer efficiency of paddy on tidal swamp land. *E-Journal Menara Perkebunan*, 88(2), 111–119. <https://doi.org/10.22302/iribb.jur.mp.v88i2.378>
- Kareem, H. A., Riaz, S., Sadia, H., & Mehmood, R. (2023). Industrial waste, types, sources, pollution potential, and country-wise comparisons. *Waste Problems and Management in Developing Countries*, 169–203. <https://doi.org/10.1201/9781003283621-8>.
- Kathpalia, R., & Bhatla, S. C. (2018). Plant Mineral Nutrition. *Plant Physiology, Development and Metabolism*, 37–81. https://doi.org/10.1007/978-981-13-2023-1_2
- Khasanah, U., Mindari, W., & Suryaminarsih, P. (2021). Kajian Pencemaran Logam Berat Pada Lahan Sawah Di Kawasan Industri Kabupaten Sidoarjo Assessment of Heavy Metals Pollution on Rice Field in Sidoarjo Regency Industrial Area. *Jurnal Teknik Kimia*, 15(2), 73.
- Khoshru, B., Mitra, D., Nosratabad, A. F., Reyhanitabar, A., Mandal, L., Farda, B., Djebaili, R., Pellegrini, M., Guerra-Sierra, B. E., Senapati, A., Panneerselvam, P., & Mohapatra, P. K. Das. (2023). Enhancing Manganese Availability for Plants through Microbial Potential: A Sustainable Approach for Improving Soil Health and Food Security. *Bacteria*, 2(3), 129–141. <https://doi.org/10.3390/bacteria2030010>
- Kristanto, B. A. (2018). Aplikasi Silika Untuk Pengelolaan Kesuburan Tanah Dan Peningkatan Produktivitas Padi Secara Berkelanjutan Budi. In *Seminar Nasional Lingkungan, Ketahanan Dan Keamanan Pangan “Optimalisasi Potensi Lingkungan Untuk Mewujudkan Ketahanan dan Keamanan Pangan”* (Vol. 53, Issue 9). <https://pasca.uns.ac.id/s2ilmulingkungan/wp-content/uploads/sites/25/2018/05/PROSIDING-SEMNAS-FINISH-2018.pdf>
- Li, H., Santos, F., Butler, K., & Herndon, E. (2021). A Critical Review on the Multiple Roles of Manganese in Stabilizing and Destabilizing Soil Organic Matter. *Environmental Science and Technology*, 55(18), 12136–12152. <https://doi.org/10.1021/acs.est.1c00299>
- Li, Y., Cui, S., Chang, S. X., & Zhang, Q. (2019). Liming effects on soil pH and crop yield depend on lime material type, application method and rate, and crop species: a global meta-analysis. *Journal of Soils and Sediments*, 19(3), 1393–1406. <https://doi.org/10.1007/s11368-018-2120-2>
- Luthfiah, A., Deawati, Y., Lutfi Firdaus, M., Rahayu, I., & Eddy, D. R. (2021). Silica from natural sources: A review on the extraction and potential application as a supporting photocatalytic material for antibacterial activity. *Science and Technology Indonesia*, 6(3), 144–155. <https://doi.org/10.26554/sti.2021.6.3.144-155>
- Magdoff, F., & Van Es, H. (2021). Building Soils for Better Crops: Ecological

- management for healthy soils. *Sustainable Agriculture Research and Education Program*, 156(5), 371.
- McMahon, G. (2010). *Extraction of fulvic minerals from humic substances*. 1(12), 8–10.
- Mengel, K., Kirkby, E. A., Kosegarten, H., & Appel, T. (2001). *Principles of Plant Nutrition*. Springer Netherlands. <https://doi.org/10.1007/978-94-010-1009-2>
- Millaleo, R., Alvear, M., Aguilera, P., González-Villagra, J., de la Luz Mora, M., Alberdi, M., & Reyes-Díaz, M. (2020). Mn Toxicity Differentially Affects Physiological and Biochemical Features in Highbush Blueberry (*Vaccinium corymbosum* L.) Cultivars. *Journal of Soil Science and Plant Nutrition*, 20(3), 795–805. <https://doi.org/10.1007/s42729-019-00166-0>
- Mindari, W., Sasongko, P. E., Aditya, H. F., Karam, D. S., & Masri, I. N. (2023). Fertility Index of Industrial Polluted Land and Plant Response to Heavy Metal Contamination. *Malaysian Journal of Soil Science*, 27(Cd), 125–137.
- Mushtaq, A., Jamil, N., Rizwan, S., Mandokhel, F., Riaz, M., Hornyak, G. L., Najam Malghani, M., & Naeem Shahwani, M. (2018). Engineered Silica Nanoparticles and silica nanoparticles containing Controlled Release Fertilizer for drought and saline areas. *IOP Conference Series: Materials Science and Engineering*, 414, 012029. <https://doi.org/10.1088/1757-899X/414/1/012029>
- Muyen, Z., Moore, G. A., & Wrigley, R. J. (2011). Soil salinity and sodicity effects of wastewater irrigation in South East Australia. *Agricultural Water Management*, 99(1), 33–41. <https://doi.org/10.1016/j.agwat.2011.07.021>
- Nardi, S., Schiavon, M., & Francioso, O. (2021). Chemical structure and biological activity of humic substances define their role as plant growth promoters. *Molecules*, 26(8). <https://doi.org/10.3390/molecules26082256>
- Ngatijo, N., Bemis, R., & Ihsan, M. (2020). *Nanofikasi Fraksi Tanah Gambut Untuk Bahan Modifermaterial Canggih Sebagai Solusi Penanggulangan Pencemaran Zat Warna Pada Perairan Pemukimanpengrajin Batik Jambi*.
- Ngoune Tandzi, L., Mutengwa, C., Ngonkeu, E., & Gracen, V. (2018). Breeding Maize for Tolerance to Acidic Soils: A Review. *Agronomy*, 8(6), 84. <https://doi.org/10.3390/agronomy8060084>
- Olgun, O. (2016). Manganese in poultry nutrition and its effect on performance and eggshell quality. *World's Poultry Science Journal*, 73(1), 45–56. <https://doi.org/10.1017/S0043933916000891>
- Pandey, A. K., Pandey, S. D., & Misra, V. (2000). Stability Constants of Metal-Humic Acid Complexes and Its Role in Environmental Detoxification. *Ecotoxicology and Environmental Safety*, 47(2), 195–200. <https://doi.org/10.1006/eesa.2000.1947>
- Paramitha, T., Saputra, T. R., Aliah, A. N., Tarigan, A. V., & Ghozali, M. (2019). Karakterisasi Silika Dari Abu Ampas Tebu. *KOVALEN: Jurnal Riset Kimia*, 5(3), 290–298. <https://doi.org/10.22487/kovalen.2019.v5.i3.14309>
- Pranckietien, I., & Jodaugien, D. (2020). The Influence of Various Forms of Nitrogen Fertilization and Meteorological Factors on Nitrogen Compounds in

- Soil under Laboratory Conditions. *Agronomy*, 10(12). <https://doi.org/10.3390/agronomy10122011>
- Puttaswamy, C. (2023). *Effect of Humic Acid on Soil Microbial Population and Enzymatic Activity Effect of Humic Acid on Soil Microbial Population and Enzymatic Activity*. November 2018. <https://doi.org/10.20546/ijcmas.2018.711.198>
- Rabot, E., Wiesmeier, M., Schlüter, S., & Vogel, H. J. (2018). Soil structure as an indicator of soil functions: A review. *Geoderma*, 314(June 2017), 122–137. <https://doi.org/10.1016/j.geoderma.2017.11.009>
- Rahayu, R. D., Mindari, W., & Moch. Arifin, M. A. (2022). Pengaruh Kombinasi Silika dan Asam Humat terhadap Ketersediaan Nitrogen dan Pertumbuhan Tanaman Padi pada Tanah Berpasir. *Soilrens*, 19(2), 23. <https://doi.org/10.24198/soilrens.v19i2.38361>
- Rahmawati, A., & Santoso, S. J. (2013). Studi Adsorpsi Logam Pb(II) Dan Cd(II) Pada Asam Humat Dalam Medium Air. *Alchemy*. <https://doi.org/10.18860/al.v0i0.2296>
- Rashmi, I., Kumawat, A., Munawery, A., Sreekumar Karthika, K., Kumar Sharma, G., Kala, S., & Pal, R. (2023). Soil Amendments: An Ecofriendly Approach for Soil Health Improvement and Sustainable Oilseed Production. In *Oilseed Crops - Uses, Biology and Production*. IntechOpen. <https://doi.org/10.5772/intechopen.106606>
- Rathor, P., Gorim, L. Y., & Thilakarathna, M. S. (2023). Plant physiological and molecular responses triggered by humic based biostimulants - A way forward to sustainable agriculture. *Plant and Soil*, 492(1–2), 31–60. <https://doi.org/10.1007/s11104-023-06156-7>
- Räty, M., Keskinen, R., Yli-Halla, M., Hyvönen, J., & Soinne, H. (2021). Estimating cation exchange capacity and clay content from agricultural soil testing data. *Agricultural and Food Science*, 30(4), 131–145. <https://doi.org/10.23986/afsci.111107>
- Rayner, G., & Canham. (2013). *Descriptive Inorganic Chemistry* (berilustra, Vol. 6). Macmillan Learning.
- Regelink, I. C., Stoof, C. R., Rousseva, S., Weng, L., Lair, G. J., Kram, P., Nikolaidis, N. P., Kercheva, M., Banwart, S., & Comans, R. N. J. (2015). Linkages between aggregate formation, porosity and soil chemical properties. *Geoderma*, 247–248, 24–37. <https://doi.org/10.1016/j.geoderma.2015.01.022>
- Reichardt, K., & Timm, L. C. (2020). How Plants Absorb Nutrients from the Soil. In *Soil, Plant and Atmosphere* (pp. 313–330). Springer International Publishing. https://doi.org/10.1007/978-3-030-19322-5_16
- Riaz, M. U., Ayub, M. A., Khalid, H., ul Haq, M. A., Rasul, A., ur Rehman, M. Z., & Ali, S. (2020). Fate of Micronutrients in Alkaline Soils. In *Resources Use Efficiency in Agriculture* (pp. 577–613). Springer Singapore. https://doi.org/10.1007/978-981-15-6953-1_16
- Rinklebe, J., Shaheen, S. M., & Yu, K. (2016). Release of As, Ba, Cd, Cu, Pb, and

- Sr under pre-definite redox conditions in different rice paddy soils originating from the U.S.A. and Asia. *Geoderma*, 270, 21–32. <https://doi.org/10.1016/j.geoderma.2015.10.011>
- Rosariastuti, R., Barokah, U., Purwanto, P., & Supriyadi, S. (2018). Phytoremediation of Pb contaminated paddy field using combination of Agrobacterium sp. I3, compost and ramie (*Boehmeria nivea*). *Journal of Degraded and Mining Lands Management*, 5(4), 1381–1388. <https://doi.org/10.15243/JDMLM.2018.054.1381>
- Sadewa, B., Niswati, A., Aini, S. N., & Yusnaini, S. (2020). Pengaruh Aplikasi Asam Humat dan Pemupukan Fosfat terhadap Populasi dan Biomassa Cacing Tanah pada Pertanaman Jagung (*Zea mays L.*) di Tanah Ultisol. *Journal of Tropical Upland Resources (J. Trop. Upland Res.)*, 2(1), 36–45. <https://doi.org/10.23960/jtur.vol2no1.2020.77>
- Sahebi, M., Hanafi, M. M., Siti Nor Akmar, A., Rafii, M. Y., Azizi, P., Tengoua, F. F., Nurul Mayzaitul Azwa, J., & Shabanimofrad, M. (2015). Importance of silicon and mechanisms of biosilica formation in plants. *BioMed Research International*, 2015. <https://doi.org/10.1155/2015/396010>
- Santana Costa, J. A., & Paranhos, C. M. (2018). Systematic evaluation of amorphous silica production from rice husk ashes. *Journal of Cleaner Production*, 192, 688–697. <https://doi.org/10.1016/j.jclepro.2018.05.028>
- Saraswati, R., Saraswati, R., & Praptana, R. H. (2017). Percepatan Proses Pengomposan Aerobik Menggunakan Biodekomposer / Acceleration of Aerobic Composting Process Using Biodecomposer. *Perspektif*, 16(1), 44–57. <https://doi.org/10.21082/psp.v16n1.2017>
- Sari, S. M., Kumolontang, W. J. N., & Warouw, V. R. C. (2021). Analisis Kadar Hara Nitrogen Total Pada Tanah Sawah Di Tapadaka Kecamatan Dumoga Tenggara Kabupaten Bolaang Mongondow. *Soil-Env*, 29–33.
- Seran, R. (2017). Pengaruh mangan sebagai unsur hara mikro esensial terhadap kesuburan tanah dan tanaman. *Jurnal Pendidikan Biologi*, 2(1), 13–14.
- Shrivastav, P., Prasad, M., Singh, T. B., Yadav, A., Goyal, D., Ali, A., & Dantu, P. K. (2020). Role of Nutrients in Plant Growth and Development. *Contaminants in Agriculture: Sources, Impacts and Management*, 43–59. https://doi.org/10.1007/978-3-030-41552-5_2
- Siam, H. S., Abd El-Moez, M. R., Abou Zeid, S. T., & Holah, S. S. (2019). Effect of silicon addition to different fertilizer on the yield, Cu and Zn content of rice plants (*Oryza sativa L.*). *Plant Archives*, 19(2001), 2219–2225.
- Singh, A. K., Kumar, A., & Chandra, R. (2022). Environmental pollutants of paper industry wastewater and their toxic effects on human health and ecosystem. *Bioresource Technology Reports*, 20, 101250. <https://doi.org/10.1016/j.biteb.2022.101250>
- Siswanto, B. (2019). Sebaran Unsur Hara N, P, K Dan Ph Dalam Tanah. *Buana Sains*, 18(2), 109. <https://doi.org/10.33366/bs.v18i2.1184>
- Slamet, J. S. (2014). *Kesehatan lingkungan* (Cetakan ke). Yogyakarta : Gadjah

- Mada University Press.
- Sou/Dakouré, M. Y., Mermoud, A., Yacouba, H., & Boivin, P. (2013). Impacts of irrigation with industrial treated wastewater on soil properties. *Geoderma*, 200–201, 31–39. <https://doi.org/10.1016/j.geoderma.2013.02.008>
- Sruthi, P., Shackira, A. M., & Puthur, J. T. (2017). Heavy metal detoxification mechanisms in halophytes: an overview. *Wetlands Ecology and Management*, 25(2), 129–148. <https://doi.org/10.1007/s11273-016-9513-z>
- Stevenson, F. J. (1982). *Humus Chemistry: Genesis, Composition, Reactions* (John Wiley & Sons (ed.)).
- Stevenson, F. J. (1995). Humus Chemistry: Genesis, Composition, Reactions, Second Edition (Stevenson, F. J.). *Journal of Chemical Education*, 72(4), A93. <https://doi.org/10.1021/ed072pA93.6>
- Su, Q., Zhang, X., Zhang, Y., Sun, G., Li, Z., Xiang, L., & Cai, J. (2023). Risk assessment of heavy metal pollution in agricultural soil surrounding a typical pharmaceutical manufacturing complex. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.1105910>
- Sudarwati, H., Natsir, M. H., & Nurgiartiningsih, V. M. A. (2019). *Statistika dan Rancangan Percobaan*. https://www.google.co.id/books/edition/Statistika_dan_Rancangan_Percobaan/hbePDwAAQBAJ?hl=en&gbpv=0%0Ahttps://www.google.co.id/books/edition/Statistika_dan_Rancangan_Percobaan/hbePDwAAQBAJ?hl=en&gbpv=1&dq=peterakan&printsec=frontcover%0Ahttps://books.goo
- Tan, K. H. (2014). *Humic Matter in Soil and the Environment*. CRC Press. <https://doi.org/10.1201/b17037>
- Tang, Z., Chen, J., & Zhang, Y. (2024). Soil C, N, and P contents and organic phosphorus mineralization in constructed wetlands with different litter input in northern China. *Journal of Soils and Sediments*, 24(7), 2736–2750. <https://doi.org/10.1007/s11368-024-03849-z>
- Triharto, S. (2013). *Survei dan Pemetaan Unsur Hara N, P, K, dan pH Tanah pada Lahan Sawah Tadah Hujan di Desa Durian Kecamatan Pantai Labu*. <https://repository.usu.ac.id/handle/123456789/58339>
- Wang, M., Chen, S., Chen, L., Wang, D., & Zhao, C. (2019). The responses of a soil bacterial community under saline stress are associated with Cd availability in long-term wastewater-irrigated field soil. *Chemosphere*, 236, 124372. <https://doi.org/10.1016/j.chemosphere.2019.124372>
- Wanti Mindari, Purnomo Edi Sassongko, & Syekhfani. (2022). *Asam Humat*.
- Weil, R., & Brady, N. (2017). *The Nature and Properties of Soils. 15th edition*.
- White, B., Tubana, B., Babu, T., Mascagni, H., Agostinho, F., Datnoff, L., & Harrison, S. (2017). Effect of Silicate Slag Application on Wheat Grown Under Two Nitrogen Rates. *Plants*, 6(4), 47. <https://doi.org/10.3390/plants6040047>
- Wiel, C. C. M. Van De, Linden, C. G. Van Der, & Scholten, O. E. (2016).

- Improving phosphorus use efficiency in agriculture: opportunities for breeding. *Euphytica*, 207(1), 1–22. <https://doi.org/10.1007/s10681-015-1572-3>
- Xie, S., Tran, H.-T., Pu, M., & Zhang, T. (2023). Transformation characteristics of organic matter and phosphorus in composting processes of agricultural organic waste: Research trends. *Materials Science for Energy Technologies*, 6, 331–342. <https://doi.org/10.1016/j.mset.2023.02.006>
- Xu, J., Mohamed, E., Li, Q., Lu, T., Yu, H., & Jiang, W. (2021). Effect of Humic Acid Addition on Buffering Capacity and Nutrient Storage Capacity of Soilless Substrates. *Frontiers in Plant Science*, 12(July), 1–12. <https://doi.org/10.3389/fpls.2021.644229>
- Yadav, P., Swaroop, N., & Thomas, T. (2020). Analysis of Physico-Chemical Properties and Available Macro Nutrient Status of Soil Blocks of Alwar District Rajasthan, India. *International Journal of Current Microbiology and Applied Sciences*, 9(7), 1834–1842. <https://doi.org/10.20546/IJCMAS.2020.907.211>
- Zhang, S., Zhu, Q., de Vries, W., Ros, G. H., Chen, X., Muneer, M. A., Zhang, F., & Wu, L. (2023). Effects of soil amendments on soil acidity and crop yields in acidic soils: A world-wide meta-analysis. *Journal of Environmental Management*, 345, 118531. <https://doi.org/10.1016/j.jenvman.2023.118531>
- Zhou, H., & Fu, C. (2020). Manganese-oxidizing microbes and biogenic manganese oxides: characterization, Mn(II) oxidation mechanism and environmental relevance. *Reviews in Environmental Science and Bio/Technology*, 19(3), 489–507. <https://doi.org/10.1007/s11157-020-09541-1>