

DAFTAR PUSTAKA

- Aini, L. N., Mulyono & E. Hanudin. 2016. Mineral mudah lapuk material piroklastik Merapi dan potensi keharaannya bagi tanaman. *Planta Tropika J. of Agro Science*. 4(2) : 84-94.
- Ali, F., Q. Peng, D. Wang, Z. Cui, J. Huang, D. Fu & D. Liang. 2017. Effects of selenite and selenate application on distribution and transformation of selenium fractions in soil and its bioavailability for wheat (*Triticum aestivum* L.). *Environ. Sci. Pollut. Res.* 24 : 8315-8325.
- Alloway, B.J. 2008. Zinc in soils and crop nutrition. 2nd Edition. International Zinc Association and International Fertilizer Industry Association. Brussels & Paris. 139 p.
- Anderson, M.S., H.W Lakin, K.C. Beeson, F.F. Smith & E. Thacker. 1961. Selenium in agriculture. US Department of Agriculture. Washington DC. 70 p.
- Arabia, T., Manfarizah, & B.I. Syakur. 2018. Karakteristik tanah Inceptisol yang disawahkan di Kecamatan Indrapuri Kabupaten Aceh Besar. *J. Floratek* 13 (1): 1-10.
- Araujo, A.M., J.H. de Lima Lessa, F.R.D. de Lima, J.F. Raymundo, N. Curi, L.R.G. Guilherme & G. Lopes. 2020. Adsorption of selenite in tropical soils as affected by soil management, ionic strength, and soil properties. *Journal of Soil Science and Plant Nutrition*. 20:139-148.
- Atulba, S.L., J. Gutierrez & G.W. Kim. 2015. Evaluation of rice root oxidizing potential using digital image analysis. *J Korean Soc Appl Biol Chem*. 58 : 463–471.
- Badan Pusat Statistik. 2024. Statistik Indonesia 2024. Badan Pusat Statistik. Jakarta. 852 p.
- Balittanah. 2022. Sifat fisik tanah dan metode analisisnya. Edisi 2. Balai Besar Litbang Sumberdaya Lahan Pertanian. Bogor. 322 p.
- Barokah, U., U. Susanto, M. Swamy, D.W. Djoar & Parjanto. 2018. High-zinc rice as a breakthrough for high nutritional rice breeding program. *IOP Conf. Series: Earth and Environmental Science*. 129:012004.
- Bashir, K., Y. Ishimaru & N.K. Nishizawa. 2012. Molecular mechanism of zinc uptake and translocation in rice. *Plant and Soil J.* 361 (1-2) : 189-201.
- Becker, M. & F. Asch. 2005. Iron toxicity in rice—conditions and management concepts. *J. Plant Nutr. Soil Sci.* 168 : 558–573.

- Brown, P.H., I. Cakmak & Q. Zhang. 1993. Form and function of zinc in plants. *In*. A.D. Robson (Eds.). Zinc in Soils and Plants. Kluwer Academic Publishers. Dordrecht. 90-106.
- BPSI Tanah dan Pupuk. 2023. Petunjuk teknis analisis kimia tanah, tanaman, air dan pupuk. Edisi 3. Balai Besar Pengujian Standar Instrumen Sumberdaya Lahan Pertanian. Bogor. 271 p.
- Bunquin, M.A.B., S. Tandy, S.J. Beebout & R. Schulin. 2017. Influence of soil properties on zinc solubility dynamics under different redox condition in non-calcareous soils. *Pedosphere*. 27(1) : 96-105.
- Christophersen, O.A., G. Lyons, A. Haug & E. Steinnes. 2013. Selenium. *In*. B.J. Alloway (Eds.). Heavy metals in soils: trace metals and metalloids in soil and their bioavailability. *Environmental Pollution*. 22: 429-464.
- Dai, H., W. Shuhe & I. Twardowska. 2020. Biofortification of soybean (*Glycine max* L.) with Se and Zn, and enhancing its physiological functions by spiking these elements to soil during flowering phase. *J Science of the Total Environment*. 740: 139648.
- Das, S., M. Jahiruddin, M.R. Islam, A.A. Mahmud, A. Hossain & A.M. Laing. 2020. Zinc biofortification in the grains of two wheat (*Triticum aestivum* L.) varieties through fertilization. *Acta Agrobotanica*. 7312.
- do Nascimento da Silva, E. & S. Cadore. 2019. Bioavailability assessment of copper, iron, manganese, molybdenum, selenium and zinc from selenium-enriched lettuce. *Journal of Food Science*. 84(10) : 2840-2846.
- De Datta, S.K. 1981. Principles and practices of rice production. John Wiley & Sons. New York. 642p.
- Deng, N., H. Zhu, J. Xiong, S. Gong, K. Xie, Qi. Shang & X. Yang. 2023. Magnesium deficiency stress in rice can be alleviated by partial nitrate nutrition supply. *Plant Physiology and Biochemistry*. 196 : 463-471.
- Dhillon, K.S., S.K. Dhillon & Bijay-Singh. 2019. Genesis of seleniferous soils and associated animal and human health problems. *In* : D.L. Sparks (Ed.). *Advances in Agronomy Volume 154*. Elsevier Inc. Academic Press. Burlington. 1-80.
- Dieroff, T.D., T.H. Fairhurst & E.W. Mutert. 2001. Soil fertility kit: a toolkit for acid, upland soil fertility management in southeast asia-handbook series. Singapore. 159 p.

- Dobermann, A. & T. Fairhurst. 2000. Nutrient disorders & nutrient management. Potash & Phosphate Institute (PPI), Potash & Phosphate Institute of Canada (PPIC), and IRRI.
- Ei H.H., T. Zheng, M.U. Farooq, R. Zeng, Y. Su, Y. Zhang, Y. Liang, Z. Tang, X. Ye, X. Jia, & J. Zhu. 2020. Impact of selenium, zinc and their interaction on key enzymes, grain yield, selenium, zinc concentrations, and seedling vigor of biofortified rice. *J Environmental Science and Pollution Research*. 27 : 16940-16949.
- Ethan, S. 2015. Effect of flooding on chemistry of paddy soils: a review. *International Journal of Innovative Science, Engineering & Technology*. 2(4) : 414-420.
- Fan, J. Y. Zeng & J. Sun. 2018. The transformation and migration of selenium in soil under different Eh conditions. *Journal of Soil and Sediments*. 18:2935-2947.
- FAO. 2019. Standard operating procedure for soil organic carbon Walkley-Black method (titration and colorimetric method). Global Soil Laboratory Network. Rome. 25 p.
- FAO^a. 2022. Standard operating procedure for cation exchange capacity and exchangeable bases 1N ammonium acetate, pH 7.0 method. Global Soil Laboratory Network. Rome. 17 p.
- FAO^b. 2022. Standard operating procedure for soil available micronutrients (Cu, Fe, Mn, Zn) and heavy metals (Ni, Pb, Cd), DTPA extraction method. Global Soil Laboratory Network. Rome. 11 p.
- Fernandes, K.F.M., R.S. Berton & A.R. Coscione. 2014. Selenium biofortification of rice and radish : effect of soil texture and efficiency of two extractants. *Plant Soil Environ*. 60(3) : 105-110.
- Filek, M. A. Sieprawska, A. Telk, M. Labanowska, M. Kurdziel, S. Walas & H. Hartikainen. 2019. Translocation of elements and sugars in wheat genotypes at vegetative and generative stages under continuous selenium exposure. *Science of Food and Agriculture*. 99(14) : 6364-6371.
- Galić, L., V. Galić, V. Ivezić, V. Zebec, J. Jović, M. Đikić, A. Filipović, M. Manojlović, A.R. Almás & Z. Lončarić. 2023. Modelling leverage of different soil properties on selenium water-solubility in soils of Southeast Europe. *Agronomy*. 13(3): 824.
- Ganguly, R., A. Sarkar, D. Dasgupta, K. Acharya, C. Keswani, V. Popova, T. Minkina. A.Y. Maksimov & N. Chakraborty. 2022. Unravelling the efficient applications

of zinc and selenium for mitigation of abiotic stress in plants. *Agriculture*. 12:1551.

- Ghozali, I. 2016. Aplikasi analisis multivariete dengan program IBM SPSS 23. Edisi 8. Badan Penerbit Universitas Diponegoro. Semarang.
- Gibson, R.S. 2023. Principles of nutritional assessment. 3rd edition. Zinc. <<https://nutritionalassessment.org./zinc/index.html>> (Diakses 7 April 2024).
- Gohil, N.B. D.P. Patel, B.A. Patel & O.I Pathan. 2017. Effect of soil application of Fe and Zn on nutrient content and uptake by two rice varieties. *International Journal of Chemical Studies*. 5 (2) : 396-400.
- Grujicic, D. A.M. Yazici, Y. Tutus, I. Cakmak & B.R. Singh. 2021. Biofortification of silage maize with zinc, iron and selenium as affected by nitrogen fertilization. *Plants*. 10 : 391.
- Guo, Q., J. Ye, J. Zeng, L. Chen, H. Korpelainen & C. Li. 2023. Selenium species transforming along soil-plant continuum and their beneficial roles for horticultural crops. *Hortic Res*. 2(10)(2):uhac270.
- Guwela, V.F. M.R. Broadley, M.J. Hawkswford, M.F.A. Maliro, J. Bokosi, M. Banda, S. Grewal, L. Wilson & J. King. 2024. Unravelling the impact of soil types on zinc, iron and selenium concentrations in grains and straw of wheat/*Amblypyrum muticum* and wheat/*Triticum urartu* doubled haploid lines. *Front. Agron*. 6 : 1305034.
- Haefele, S.M., A. Nelson & R.J. Hijmans. 2014. Soil quality and constraints in global rice production. *Geoderma* (235-236) : 250-259.
- Hardjowigeno, S. 1993. Klasifikasi tanah dan pedogenesis. Akademika Pressindo. Jakarta.
- Hardjowigeno, S. Subagyo H. & M L. Rayes, M.L. 2004. Morfologi dan klasifikasi tanah sawah. *In*. F. Agus, A. Adimiharja, S. Hardjowigeno, A.M. Fagi, W. Hartatik (Eds.). Tanah sawah dan teknologi pengelolaannya. Pusat penelitian dan pengembangan tanah dan agroklimat. Balai Litbang Pertanian. Bogor. 377 p.
- Hasnain, Z. S. Khan, F. Nasrullah, K. Mehmood, D. Ibrar, S. Bashir, A. Bakhsh, I. Aziz, A. Rais, N. Farooq, S. Irshad, N. Rashid, J. Alkahtani & M.S. Elshikh. 2022. Impact of different levels of zinc nad nitrogen on growth, productivity, and quality of aromatic rice cultivated under various irrigation regime in two districts of Pakistan. *Front. Plant. Sci*. 13:951565.

- Haug, A., R.D. Graham, O.A. Christophersen & G.H. Lyons. 2007. How to use the world's scarce selenium resources efficiently to increase the selenium concentration in food. *Microb Ecol Health Dis.* 19(4): 209-228.
- Havlin, J.L, S.L. Tisdale, W.L. Nelson & J.D. Beaton. 2017. Soil fertility and fertilizers an introduction to nutrient management. 8th edition. Pearson India Education Services. Uttar Pradesh. 529 p.
- Hoffland, E., C. Wei & M. Wissuwa. 2006. Organic anion exudation by lowland rice (*Oryza sativa* L.) at zinc and phosphorus deficiency. *J Plant and Soil.* 283:155-162.
- Hu, Z., Y. Cheng, N. Suzuki, X. Guo, H. Xiong & Y. Ogra. 2018. Speciation of selenium in brown rice fertilized with selenite and effects of selenium fertilization on rice proteins. *Int J Mol Sci.* 6;19(11):3494. doi: 10.3390/ijms19113494. PMID: 30404212; PMCID: PMC6274819.
- Huang, C., W. Yang, L. Duan, N. Jiang, G. Chen, L. Xiong & Q. Liu. 2013. Rice panicle length measuring system based on dual-camera imaging. *Computer and electronics in agriculture.* 98 : 158-165.
- Huang, S. N. Yamaji & J.F. Ma. 2022. Zinc transport in rice : how to balance optimal plant requirements and human nutrition. *Journal of Experimental Botany.* 73(6):1800-1808.
- Husein, S. & Srijono. 2010. Peta geomorfologi Daerah Istimewa Yogyakarta. Conference Paper.
- Husson, O., B. Husson, A. Brunet, D. Babre, K. Alary, J.P. Sarthou, H. Charpentier, M. Durand, J. Benada & M. Henry. 2016. Practical improvements in soil redox potential (Eh) measurement for characterisation of soil properties. Application for comparison of conventional and conservation agriculture cropping systems. *Analytica Chimica Acta* 906 : 98-109.
- International Rice Research Institute. 1972. Annual report for 1971. Los Banos, Philippines. 252 p.
- Institute of Medicine Panel on Micronutrients. 2001. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium and zinc. National Academic Press. Washington DC.
- Ishimaru, Y., M. Suzuki, T. Kobayashi, M. Takahashi, H. Nakanishi, S. Mori & N.K. Nishizawa. 2005. OsZIP4, a novel zinc-regulated zinc transporter in rice. *J of Experimental Botany.* 56(422) : 3207-3214.

- Islam, M.R. A. Sultana, M. Jahiruddin & S. Islam. 2021. Effect of soil application of zinc on growth, yield, and zinc concentration in rice varieties. *European Journal of Agriculture and Food Sciences*. 3(6):117-122.
- Ismail, M.S. F. Nawaz, M.A. Shehzad, T.U. Haq & M.Y. Ashraf. 2024. Selenium biofortification impacts nutritional composition and storage proteins in wheat grains. *Journal of Food Composition and Analysis*. 127:105961.
- IUSS Working Group WRB. 2022. World reference base for soil resources. International Soil Classification System for Naming Soils and Creating Legends for Soil Maps. 4th Edition. International Union of Soil Sciences (IUSS). Vienna, Austria.
- Kabata-Pendias, A. & H. Pendias. 2001. Trace elements in soils and plants. Third edition. CRC press. New York. 331 p.
- Kong, W., R. Huo, Y. Lu, Z. Fan, R. Yue, A. Ren, L. Li, P. Ding, Y. Ren & Z. Gao. 2023. Nitrogen application can optimize form of selenium in soil in selenium-rich areas to affect selenium absorption and accumulation in black wheat. *Plants*. 12(24) : 4160.
- Kementerian Kesehatan Republik Indonesia. 2023. Buku saku hasil survei status gizi Indonesia (SSGI) 2022. <<https://kesmas.kemkes.go.id/assets/uploads/contents/attachments/09fb5b8ccfd088080f2521ff0b4374f.pdf>> (diakses 17 September 2023).
- Khresat, S.A. 2004. Formation and properties of Inceptisols (Cambisols) of major agricultural rainfed areas in Jordan. *Archives of Agronomy and Soil Science*. 51 (1): 15-23.
- Krauskopf, K.B. & D.K. Bird. 1995. Introduction to Geochemistry. McGraw-Hill Inc. New York. 647 p.
- Kumar, S.P., S.N. Reddy & A.S. Sankar. 2017. Influence of zinc on yield attributes and yield of aromatic rice. *International Journal of Farm Sciences*. 7(4):144-148.
- Lessa, J.H.L. A.M. Araujo, L.A. Ferreira, E.C.S. Junior, C. Oliviera, A.P.B. Corguinha, F.A.D. Martins, H.W.P. Carvalho, L.R.G. Guilherme & G. Lopes. 2019. Agronomic biofortification of rice (*Oryza sativa* L.) with selenium and its effect on element distributions in biofortified grains. *Plant Soil*. 444:331-342.
- Lestari, S.A.D., M. Melati & H. Purnamawati. 2015. Penentuan dosis optimum pemupukan N, P, dan K pada tanaman kacang bogor (*Vigna subterranea* L. Verdcourt). *J. Agron Indonesia* 43(3) : 193-200.

- Li, H.F., E. Lombi, J.L. Stroud, S.P. McGrath & F.J. Zhao. 2010. Selenium speciation in soil and rice: influence of water management and Se fertilization. *J. Agric. Food Chem.* 58: 11837-11843.
- Linam, F.A., M.A. Limmer & A.L. Seyfferth. 2024. Contrasting roles of rice root iron plaque in retention and plant uptake of silicon, phosphorus, arsenic, and selenium in diverse paddy soils. *Plant & Soil.* 502 : 397- 415.
- Liu, D.Y., Y.M. Liu, W. Zhang, X.P. Chen & C.Q. Zou. 2019. Zinc uptake, translocation, and remobilization in winter wheat as affected by soil application of Zn fertilizer. *Frontiers In Plant Science.* 10:426.
- Liu, Q., D.J. Wang, X.J. Jiang & Z.H. Cao. 2004. Effects of the interactions between selenium and phosphorus on the growth and selenium accumulation in rice (*Oryza Sativa*). *Environmental Geochemistry and Health.* 26: 325–330.
- Longchamp, M. M. Castrec-Rouelle, P. Biron & T. Bariac. 2015. Variations in the accumulation, localization and rate of metabolization of selenium in mature *Zea mays* plants supplied with selenite or selenate. *Food Chemistry.* 182 : 128-135.
- Lowe, S.E. M.K. Jain & J.G. Zeikus. 1993. Biology, ecology, and biotechnological applications of anaerobic bacteria adapted to environmental stresses in temperature, pH, salinity, or substrates. *Microbiol Rev.* 57(2): 451-509.
- Lukaszewicz, S. B. Polyticka & S. Smolén. 2018. Effects of selenium on the content of essential micronutrients and their translocation in garden pea. *Journal of Elementology.* 23(4):1307-1317.
- Lv, H., C. Ji, L. Zhang, C. Jiang, & H. Cai. 2022. Zinc application promotes nitrogen transformation in rice rhizosphere soil by modifying microbial communities and gene expression levels. *Science of The Total Environment.* 849:157858.
- Makarim, A.K. & E. Suhartatik. 2009. *Morfologi dan fisiologi tanaman padi*. Balai Besar Penelitian Tanaman Padi.
- Mangueze, A.V. de J. M.F.G. Pessoa, M.J. Silva, A. Ndayiragije, H.E. Magaia, V.S.I. Cossa, F.H. Reboredo, M.L. Carvalho, J.P. Santos, M. Guerra, A.I. Ribeiro-Barros, F.C. Lidon & J.C. Ramalho. 2018. Simultaneous zinc and selenium biofortification in rice. Accumulation, localization and implications on the overall mineral content of the flour. *Journal of Cereal Science.* 82 : 34-41.
- Mantel, S., S. Dondeyne & S. Deckers. 2023. World reference base for soil resources (WRB). *ISRIC-World Soil Information. In : M.J. Goss & M. Oliver (Eds.).*

- Encyclopedia of soils in the environment. 2nd edition. Elsevier Ltd. 4 : 206-217.
- Mao, H., J. Wang, Z. Wang, Y. Zan, G. Lyons & C. Zou. 2014. Using agronomic biofortification to boost zinc, selenium, and iodine concentrations of food crops grown on the loess plateau in China. *J of Soil Science and Plant Nutrition*. 14 (2): 459-470.
- Maret, W. 2009. Molecular aspects of human cellular zinc homeostasis: redox control of zinc potentials and zinc signals. *J Biometals*. 22: 149-157.
- Marques, A.C., D. Daccak, I.C. Luís, A.R.F. Coelho, C.C. Pessoa, P.S. Campos, M. Simões, A.S. Almeida, M.F. Pessoa, F.H. Reboredo, C. Galhano, J.C. Ramalho, L. Palha, M.M. Silva, P. Legoinha, K. Oliveira, I.P. Pais & F.C. Lidon. 2022. A case study on minerals interaction in the soil and Se enrichment in rice (*Oryza sativa* L.). *Biology and Life Sciences Forum*. 11(24) : 7 p.
- Miller, J.O. 2016. Soil pH affects nutrient availability. Technical report University of Maryland fact sheet FS-1054. <https://www.researchgate.net/publication/305775103_Soil_pH_Affects_Nutrient_Availability> (diakses 2 September 2024).
- Monisha, V., N. Thavaprakash, M. Djanaguiraman & K. Vaiyapuri. 2021. Effect of selenium on growth and yield of rice (*Oryza sativa* L.) under induced drought stress condition. *The Pharma Innovation Journal*. 10(10): 1342-1346.
- Montalvo, D., F. Degryse, R.C. da Silva, R. Baird, & M.J. 2016. McLaughlin. Agronomic effectiveness of zinc sources as micronutrient fertilizer. *In*. D.L. Sparks (Ed). *Advances in Agronomy*. 139: 215-267.
- Moldenhauer, K. P. Counce & J. Hardke. 2018. Rice growth and development. *In*. K. Moldenhauer (Eds.). *Rice Production handbook*. University of Arkansas Division of Agriculture Cooperative Extension Service. Arkansas.
- Moreno-Lora, A. & A. Delgado. 2020. Factors determining Zn availability and uptake by plants in soils developed under mediterranean climate. *Geoderma*. 376:114509.
- Mousavi, S.R. 2011. Zinc in crop production and interaction with phosphorus. *Australian Journal of Basic and Applied Sciences*. 5(9): 1503-1509.
- Mu, S. N. Yamaji, A. Sasaki, L. Luo, B. Du, J. Che, H. Shi, H. Zhao, S. Huang, F. Deng, Z. Shen, M.L. Guerinot, L. Zheng & J.F. Ma. 2021. A transporter for

- delivering zinc to the developing tiller bud and panicle in rice. *The Plant Journal*. 105:786-799.
- Mustafa, G., Ehsanullah, N. Akbar, S.A. Qaisrani, A. Iqbal, H.Z. Khan, K. Jabran, A.A. Chattan, R. Trethowan, T. Chatta & B.M. Atta. 2011. Effect of zinc application on growth and yield of rice (*Oryza sativa* L.). *IJAVMS*. 5(6): 530-535.
- Nahar, K., M. Jahiruddin, M.R. Islam & Z. Nayem. 2020. Improvement of nutrient concentration in rice grain by zinc biofortification. *Asian Journal of Advances in Agricultural Research*. 14(2):41-47.
- Nath, S. S. Dey, R. Kundu & S. Paul. 2024. Phosphate and zinc interaction in soil and plants: a reciprocal cross-talk. *Plant Growth Regulation*. <https://doi.org/10.1007/s10725-024-01201-6>
- National Institute of Health. 2021. Selenium fact sheet for consumer. <<https://ods.od.nih.gov/factsheets/Selenium-Consumer/>>. (diakses 16 April 2024).
- Neue, H.U., C. Quijano, D. Senadhira & T. Setter. 1998. Strategies for dealing with micronutrients disorders and salinity in lowland rice systems. *J Field Crops Research*. 56: 139-155.
- Nordstrom, D.K. & F.D. Wilde. 2005. Reduction-oxidation potential (electrode method). *In*. *Field Measurements Reduction-Oxidation Potential*. Version 1.2 Chapter A6. U.S. Geological Survey TWRI Book 9. Reston, VA. 22 p.
- Nursyamsi, D. & Suprihati. 2005. Sifat-sifat kimia dan mineralogi tanah serta kaitannya dengan kebutuhan pupuk untuk padi (*Oryza sativa*), jagung (*Zea mays*), dan kedelai (*Glycine max*). *J Agronomi Indonesia*. 33(3): 40 – 47.
- OECD. 2021. Revised consensus document of the biology of rice (*Oryza sativa* L.). Series on the harmonisation of regulatory oversight in biotechnology no. 70. Organisation for Economic Co-Operation and Development. Paris. 42.
- Okalebo, J.R., K.W. Gathua & P.L. Woomer. 2002. Laboratory methods of soil and plant analysis: a working manual. 2nd edition. Kenya. 131 p.
- Ochiai, K., K.Oba, K. Oda, T. Miyamoto & T. Match. 2022. Effects of improved sodium uptake ability on grain yields of rice plants under low potassium supply. *Plant Direct*. 6(4): 1-10.
- Pakpahan, R.N.A. 2022. Analisis regresi linear berganda menggunakan software R. <<https://rpubs.com/ronaulinova/905143>> (diakses 3 Oktober 2024).
- Palihakkara, J. L. Burkitt, P. Jeyakumar & C.P. Attanayake. 2024. Exploring phosphorus dynamics in submerged soils and its implications on the

- inconsistent rice yield response to added inorganic phosphorus fertilisers in paddy soils in Sri Lanka. *J. of Soil Science and Plant Nutrition*. 24 : 1-20.
- Passarelli, S., C.M. Free, A. Shepon, T.Beal, C. Batis & C.D. Godlen. 2024. Global estimation of dietary micronutrient inadequacies : a modelling analysis. *The Lancet Global Health*. Vol 12 (10) : 1590-1599.
- Patrick, W. H., Jr., and R. A. Khalid. 1974. Phosphate release and sorption by soils and sediments: effect of aerobic and anaerobic conditions. *Science* 186:53-55.
- Ponnamperuma, F.N. 1972. The chemistry of submerged soils. *Advances in agronomy*. Vol 24.
- Prasad, R., Y.S. Shivay & D. Kumar. 2016. Interactions of zinc with other nutrients in soil and plants-a review. *Indian J of Fertilisers*. 12(5) : 16-26.
- Prasetyo, B.H., J.S. Adiningsih, K. Subagyono & R.D.M. Simanungkalit. 2004. Mineralogi, kimia, fisika, dan biologi lahan sawah. *In*. Tanah sawah dan teknologi pengelolaannya. F. Agus, A. Adimiharja, S. Hardjowigeno, A.M. Fagi, W. Hartatik. Pusat penelitian dan pengembangan tanah dan agroklimat. Balai Litbang Pertanian. Bogor. 377 p.
- Praveen, Shaheen. 2019. Chemistry of potassium availability in soil. *International Journal of Chemical Studies*. 7(1) : 1916-1918.
- Premarathna, H.M.P. Lakmalie. 2011. Increasing plant availability of selenium in rice soils under variable redox conditions. Doctoral Dissertation. The University of Adelaide. Adelaide.
- Presiden Republik Indonesia. Peraturan Presiden Republik Indonesia Nomor 18 Tahun 2020 tentang Rencana Pembangunan Jangka Menengah Nasional Tahun 2020-2024.
- Presiden Republik Indonesia. Peraturan Presiden Republik Indonesia Nomor 72 Tahun 2021 tentang Percepatan Penurunan Stunting.
- Purwanto, O.D., Y. Pujiharti & R.P. Ramadhan. 2023. Growth and yield performance of upland and lowland rice varieties under narrow-wide row planting systems in East Nusa Tenggara, Indonesia. *J Planta Tropika*. 11: 1.
- Qureshi, M.T., M.F. Ahmad, N. Iqbal, H. Waheed, S. Hussain, M. Brestič, A. Anjum, & I.R. Noorka. 2021. Agronomic bio-fortification of iron, zinc and selenium enhance growth, quality and uptake of different sorghum accessions. *J Plant Soil and Environment*. 67(10): 549-577.

- RÁCZ, D. & L. RADÓCZ. 2019. Nutrient deficiency and effects of various nutrition technologies on crop health. *Acta Agraria Debreceniensis*. 2 : 109-113.
- Rahman, M., M.M.R. Jahangir, M.G. Kibria, M. Hossain, Md. Hosenuzzaman, Z.M. Solaiman & Md. A. Abedin. 2022. Determination of critical limit of zinc for rice (*Oryza sativa* L.) and potato (*Solanum tuberosum* L.) cultivation in floodplain soils of Bangladesh. *Sustainability*. 14(1):167.
- Recena, R. A. M. Garcia-López & A. Delgado. 2021. Zinc uptake by plants as affected by fertilization with Zn sulfate, phosphorus availability, dan soil properties. *Agronomy*. 11(2), 390.
- Reis, H.P.G., J.P.D.Q. Barcelos, E.F. Junior, E.F. Santos, V.M. Silva, M.F. Moraes, F.F. Putti & A.R.D. Reis. 2018. Agronomic biofortification of upland rice with selenium and nitrogen and its relation to grain quality. *Journal of Cereal Science*. 79 : 508-515.
- Resman & S.A. Siradz. 2006. Kajian beberapa sifat kimia dan fisika Inceptisol pada toposekuen lereng selatan gunung Merapi kabupaten Sleman. Universitas Gadjah Mada. Yogyakarta.
- Rosell, C.M. 2016. Fortification of grain-based foods. *In*. C. Wrigley, H. Corke, K. Seetharaman, J. Faubion (Eds.). *Encyclopedia of food grains* (second edition). 2: 43-49.
- Rosenfeld, I. & O.A. Beath. 1964. Selenium, geobotany, biochemistry, toxicity and nutrition. Academic Press Inc. New York and London. 411 p.
- Roy, P., A.K. Doluia, M. Mandalb, S. Sarkarc & D. K. Dasa. 2016. Rate of changes of potassium and cationic micronutrients in submerged soil affected by potassium and zinc interactions. *J. Indian Chem. Soc.* 93 : 47-54.
- Sajwan, K.S. & W.L. Lindsay. 1988. Effect of redox, zinc fertilization and incubation time on DTPA-extractable zinc, iron and manganese. *Communications in Soil Science and Plant Analysis*. 19:1-11.
- Sahrawat, K.L. 2004. Organic matter accumulation in submerged soils. *Advances in Agronomy*. Vol 81 : 169-201.
- Sarwar, N., M. Akhtar, M.A. Kamran, M. Imran, M.A. Riaz, K. Kamran & S. Hussain. 2020. Selenium biofortification in food crops: Key mechanisms and future perspectives. *J of Food Composition and Analysis*. 93: 103615.
- Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center. Lincoln, NE.

- Sekretariat Nasional SDGs. 2016. 2. Tanpa kelaparan. Tujuan pembangunan berkelanjutan. <<https://sdgs.bappenas.go.id/tujuan-2/#:~:text=Tujuan%20SDGs%20nomor%202%20yaitu,pangan%20dan%20penciptaan%20lapangan%20kserja>> (diakses 17 September 2023).
- Shakoor, H., J. Feehan, A.S. Al Dhaheri, H.I. Ali, C. Platat, L.C. Ismail, V. Apostolopoulos, & L. Stojanovska. 2021. Immune-boosting role of vitamins D, C, E, zinc, selenium and omega-3 fatty acids: could they help against covid-19?. *J Maturitas*. 43 :1-9.
- Shao, Y., B. Xie, M. Li, X. Zhang & H. Xiao. 2019. Selenium fractionation and speciation in paddy soils and accumulation in rice under field conditions in Jinhua Zhejiang Province, China. *E3S Web Conferences* (143).
- Shen, J. C. Jiang, Y. Yan & C. Zu. 2019. Selenium distribution and translocation in rice (*Oryza sativa* L.) under different naturally seleniferous soils. *Sustainability*. 11(520): 11 p.
- Shreenath, A.P., M.A. Ameer & J. Dooley. 2022. Selenium deficiency. <<https://www.ncbi.nlm.nih.gov/books/NBK482260/#:~:text=Selenium%20deficiency%20has%20been%20implicated,treatment%20is%20currently%20being%20studied>> (diakses 17 September 2023).
- Sofyan, A., Nurjaya & A. Kasno. 2004. Status hara sawah untuk rekomendasi pemupukan. *In*. Tanah sawah dan teknologi pengelolaannya. F. Agus, A. Adimiharja, S. Hardjowigeno, A.M. Fagi, W. Hartatik (Eds). Pusat penelitian dan pengembangan tanah dan agroklimat. Balai Litbang Pertanian. Bogor. 377 p.
- Soil Science Division Staff. 2017. Soil survey manual. *In*. C. Ditzler, K. Scheffe, and H.C. Monger (Eds.). USDA Handbook 18. Government Printing Office, Washington, D.C.
- Soil Survey Staff. 2022. Keys to soil taxonomy. 13th edition. U.S. Department of Agriculture. Natural Resources Conservation Service. 410 p.
- Solly, E.F., V. Weber, S. Zimmermann, L. Walthert, F. Hagedorn & M.W.I. Schmidt. 2019. Is the content and potential preservation of soil organic carbon reflected by cation exchange capacity? A case study in Swiss forest soils, *Biogeosciences Discuss*. [preprint].
- Song, T., X. Su, J. He, Y. Liang, T. Zhou & C. Liu. 2018. Selenium (Se) uptake and dynamic changes of Se content in soil-plant systems. *Environmental Science and Pollution Research*. 25 : 34343-34350.

- Stillings, L.L. 2017. Selenium. *In*. K.J. Schuls, J.H. DeYoung, Jr. R.R. Seal II, & D.C Bradley (Eds.). Chapter Q, Critical Mineral Resources of the United States- Economic and Environmental Geology and Prospects for Future Supply. U.S. Geological Survey Professional Paper. 1802 : Q1-Q55.
- Subardja, D., S. Ritung, M. Anda, Sukarman, E. Suryani & R.E. Subandiono. 2014. Petunjuk teknis klasifikasi tanah Nasional. Balai Besar Penelitian dan Pengembangan Sumberdaya Lahan Pertanian, Badan Penelitian dan Pengembangan Pertanian. Bogor. 22 p.
- Sulaeman & Eviati. 2000. Pengaruh pH terhadap serapan tembaga dan seng dan hara lainnya pada tanah. Prosiding pertemuan pembahasan dan komunikasi hasil penelitian tanah dan agroklimat. Bidang kimia dan biologi tanah. Bogor.
- Syachroni, S.H. 2019. Kajian beberapa sifat kimia tanah pada lahan sawah di berbagai lokasi di Kota Palembang. *Sylva VIII (2) : 60-65.*
- Teixeira, L.D.S. 2020. Selenium uptake and the nutritional quality of rice (*Oryza sativa* L.) grains are affected by nitrogen availability. Magister Dissertation. The Universidade Federal de Viçosa. Viçosa.
- Terry, N., A.M. Zyed, M.P. de Souza & A.S. Tarun. 2000. Selenium in higher plants. *Annual Reviews Plant Physiol. Plant Mol. Biol.* 51 : 401-32.
- Tolu, J. S. Bouchet, J. Helfenstein, O. Hausheer, S. Chékifi, E. Frossard, F. FAOTamburini, O.A. Chadwick & L.H.E. Winkel. 2022. Understanding soil selenium accumulation and bioavailability through size resolved and elemental characterization of soil extracts. *Nature Communications.* 13:6974.
- Tripathi, R. R. Tewari, K.P. Singh, C. Keswani, T. Minkina, A.K. Srivastava, U.D. Corato & E. Sansinenea. 2022. Plant mineral nutrition and disease resistance: a significant linkage for sustainable crop production. *Front Plant Sci.* 13 : 883970.
- Upadhyay S. & A.S. Raghubanshi. 2020. Determinants of soil carbon dynamics in urban ecosystems. *In*. P. Verma, P. Singh, R. Singh, A.S. Raghubanshi (Eds.). *Urban Ecology.* 299-314.
- Wang, Q., Y. Yu, J. Li, Y. Wan, Q. Huang, Y. Guo & H. Li. 2017. Effects of different forms of selenium fertilizers on Se accumulation, distribution, and residual effect in winter wheat-summer maize rotation system. *J. Agric. Food Chem.* 65(6): 1116-1123.

- Wang, Y., C.Tang, J. Wu, X. Liu & J. Xu. 2012. Impact of organic matter addition on pH change of paddy soils. *J of Soils and Sediments*. 13: 12-23.
- Wang, Y., K. Wang, Q. Wang, Y. Wan, Z. Zhuang, Y. Yu, & H. Li. 2020. Selenite uptake and transformation in rice seedlings (*Oryza sativa* L.): response to phosphorus nutrient status. *Front Plant Sci*. 23(11) : 874.
- Wang^a, Z., W. Huang & F. Pang. 2022. Selenium in soil-plant-microbe: a review. *Bulletin of Environmental Contamination and Toxicology*. 108: 167-181.
- Wang^b, Z., Y. Ding, X. Ren, J. Xie, S. Kumar, Z. Zhang & Q. Wang. 2022. Effect of micronutrient selenium on greenhouse gas emissions and related functional genes during goat manure composting. *Bioresource Technology*. 349:126805.
- White, P.J & M.R. Broadley. 2009. Biofortification of crops with seven mineral elements often lacking in human diets-iron, zinc, cooper, calcium, magnesium, selenium and iodine. *J New Phytologist*. 182: 49-84.
- White, P.J. 2016. Selenium accumulation by plants. *J Annals of Botany*. 117: 217-235.
- WHO. 2022. Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda. Geneva. 614 p.
- Wisawapipat, W., Y. Janlaksana & I. Christl. 2017. Zinc solubility in tropical paddy soils: A multi-chemical extraction technique study. *Geoderma*. 301 : 1-10.
- Witt, C. & S.M. Haefele. Paddy soils. 2005. *In*. D. Hillel (Eds.). *Encyclopedia of Soils in the Environment*. Elsevier Academic Press. New York. 141-150.
- Wu, C. Y. Dun, Z. Zhang, M. Li & G. Wu. 2020. Foliar application of selenium and zinc to alleviate wheat (*Triticum aestivum* L.) cadmium toxicity and uptake from cadmium-contaminated soil. *Ecotoxicology and Environmental Safety*. 190:110091.
- Xue, M., D. Wang, F. Zhou, Z. Du, H. Zhai, M. Wang, Q.T. Dinh, T.A.T Tran, H. Li, Y. Yan & D. Liang. 2020. Effects of selenium combined with zinc amendment on zinc fractions and bioavailability in calcareous soil. *J Ecotoxicology and Environmental Safety*. 190: 110082.
- Yu, H.Y., F.B. Li, C.S. Liu, W. Huang, T.X. Liu & W.M. Yu. 2016. Iron redox cycling coupled to transformation and immobilization of heavy metals: implications for paddy rice safety in the red soil of south China. *In*. D.L. Sparks (Eds.). *Advances in Agronomy*. 137: 279-317.

- Yu, T., Z. Yang, Y. Ly, Q. Hou, X. Xia, H. Feng, M. Zhang, L. Jin & Z. Kan. 2014. The origin and geochemical cycle of soil selenium in a Se-rich area of China. *J of Geochemical Exploration*. 97-108.
- Yakan, H.M., M.A. Gürbüz, F. Avsar, H. Dürek & N. Beser. 2001. The effect of zinc application on yield and some agronomic characters (On-line). *In*. Chataigner J. (Eds.). *The new development in rice agronomy and its effects on yield and quality in Mediterranean areas*. Montpellier : CIHEAM. Workshop on The New Development in Rice Agronomy and its Effects on Yield and Quality in Mediterranean Areas, Turkey. 13-15.
- Yang, M. Y. Li, Z. Liu, J. Tian, L. Liang, Y. Qiu, G. Wang, Q. Du, D. Cheng, H. Cai, L. Shi, F. Xu & X. Lian. 2020. A high activity zinc transporter osZIP9 mediates zinc uptake in rice. *The Plant Journal*. 103 (5) : 1695-1709.
- Yuniastuti, A. 2014. *Nutrisi mikromineral dan kesehatan*. Penerbit UNNES Press. X+160 halaman. ISBN 978 602 285 014 4.
- Zagrodzki, P. P. Paško, A. Galanty, M. Tyzka-Czochara, R. Wietecha-Posluszny, P.S. Rubió, H. Bartón, E. Prochownik, B. Muszyńska, K. Sulkowska-Ziaja, K. Bierla, R. Łobiński, J. Szpunar & S. Gorinstein. 2020. Does selenium fortification of kale and kohlrabi sprouts change significantly their biochemical and cytotoxic properties?. *Journal of Trace Elements in Medicine and Biology*. 59: 126466.
- Zhang, L. & C. Chu. 2022. Selenium uptake, transport, metabolism, reutilization, and biofortification in rice. *Rice*. 15(30):15 p.
- Zhang, M. G. Xing, S. Tang, Y. Pang, Q. Yi, Q. Huang, X. Huang, J. Huang, P. Li & H. Fu. 2019. Improving soil selenium availability as a strategi to promote selenium uptake by high-Se rice cultivar. *Environmental and Experimental Botany*. 163 : 45-54.
- Zhang, Y., C. Yu, J. Lin, J. Liu, B. Liu, J. Wang, A. Huang, H. Li & T. Zhao. 2017. OsMPH1 regulates plant height and improves grain yield in rice. 12(7): e0180825.
- Zhou, B. H. Cao, Q. Wu, K. Mao, X. Yang, J. Su & H. Zhang. 2023. Agronomic and genetic strategies to enhance selenium accumulation in crops and their influence on quality. *Foods*. 12(24) : 4442.
- Zhou, X., J. Yang, H.J. Kronzucker & W. Shi. 2020. Selenium biofortification and interactions with other elements in plants: a review. *Front. Plant Sci*. 11: 586421.



- Zhou, X., Y. Li & F. Lai. 2018. Effects of different water management on absorption and accumulation of selenium in rice. *Saudi Journal of Biological Sciences*. 25(6) :1178-1182.
- Zulfiqar, U., S. Hussain, M. Maqsood, M. Ishfaq & N. Ali. 2021. Zinc nutrition to enhance rice productivity, zinc use efficiency, and grain biofortification under different production system. *Crop Science*. 61(1):739-749.