



DAFTAR PUSTAKA

- Abdelaziz, M.N., T.D. Xuan, A.M.M. Mekawy, H. Wang, T.D. Khanh. 2018. Relationship of salinity tolerance to Na^+ exclusion, proline accumulation, and antioxidant enzyme activity in rice seedlings. *Agriculture*. 8: 166.
- AbdElgawad H., G. Zinta, M.M. Hegab, R. Pandey, H. Asard, & W. Abuelsoud. 2016. High salinity induces different oxidative stress and antioxidant responses in maize seedlings organs. *Front. Plant Sci.* 7: 276.
- Aguilar, M., J.L. Fernández-Ramírez, M. Aguilar-Blanes & C. Ortiz-Romero. 2017. Rice sensitivity to saline irrigation in Southern Spain. *Agricultural Water Management*. 188: 21–28.
- Akter, M. & H. Oue. 2018. Effect of saline irrigation on accumulation of Na^+ , K^+ , Ca^{2+} , and Mg^{2+} ions in rice plants. *Agriculture*. 8: 164.
- Alotaibi, M.O., A.M. Saleh, R.L. Sobrinho, M.S. Sheteiwiy, A.M. El-Sawah, A.E. Mohammed, H. AbdElgawad. 2021. Arbuscular mycorrhizae mitigate aluminum toxicity and regulate proline metabolism in plants grown in acidic soil. *J. Fungi*. 7: 531.
- Baehaki, S.E., H.M. Toha, M.Y. Samaullah, Sudarmaji, Suwarno & I.P. Wardana. 2010. Padi Gogo. Balai Besar Penelitian Padi. Sukamandi. Hal 1-33.
- Besserer A., V. Puech-Pagès, P. Kiefer, V. Gomez-Roldan, A. Jauneau, S. Roy, J.C. Portais, C. Roux, G. Bécard & N. Séjalon-Delmas. 2006 Strigolactones stimulate arbuscular mycorrhizal fungi by activating mitochondria. *PLoS Biol* 4(7): e226.
- Brundrett, M. 1991. Mycorrhizas in natural ecosystems. In: M. Begon, A.H. Fitter, A. Macfadyen (Eds.). *Advances in Ecological Research*. Academic Press. 21: 171-313.
- BPS. 2017. Kajian Konsumsi Bahan Pokok. (buku elektronik). <https://www.bps.go.id/publication/2019/06/25/bbf8ec1716fb4583687996c3/kajian-konsumsi-bahan-pokok-tahun-2017.html>. (diakses 15 November 2019).
- BPS. 2018. Proyeksi Penduduk Indonesia 2015 – 2045 (buku elektronik). <https://www.bps.go.id/publication/2018/10/19/78d24d9020026ad95c6b5965/proyeksi-penduduk-indonesia-2015-2045-hasil-supas-2015.html>. (diakses 20 Juni 2020).
- BPPP. 2017. Syarat Tumbuh Padi Gogo. (internet). <http://www.litbang.pertanian.go.id/info-teknologi/2877/>. (diakses 15 Desember 2019).



- Bryla, D.R. & D.M. Eissenstat. 2005. Respiratory costs of mycorrhizal associations. In: H. Lambers, M. Ribas-Carbo (Eds.). Plant Respiration: From Cell to Ecosystem. Advances in Photosynthesis and Respiration. vol 18. Springer. Dordrecht. 207-224.
- Chamuanah, G.S. & S.K. Dey. 1982. Determination of cation exchange capacity of woody plant roots using ammonium acetate extractant. Plant & Soil. 68: 135-138.
- Chen J., H. Zhang, X. Zhang & M. Tang. 2017. Arbuscular mycorrhizal symbiosis alleviates salt stress in black locust through improved photosynthesis, water status, and K⁺/Na⁺ homeostasis. Front. Plant Sci. 8: 1739.
- CNN Indonesia. 2018. BPS Sebut luas lahan pertanian kian menurun. (internet). <https://www.cnnindonesia.com/ekonomi/20181025153705-92-41433/bps-sebut-luas-lahan-pertanian-kian-menurun>. (diakses 15 November 2019).
- De Datta, S.K. & B.S. Vergara. 1975. Climates of Upland Rice Regions. Major Research in Upland Rice. International Rice Research Institute. Los Banos. 14-39.
- Djaenudin, D., H. Marwan, H. Subagjo & A. Hidayat. 2011. Petunjuk Teknis Evaluasi Lahan Untuk Komoditas Pertanian. Balai Besar Litbang Sumberdaya Lahan Pertanian, Badan Litbang Pertanian. Bogor. 36p.
- Dobermann A. & T. Fairhurst. 2000. Rice Nutrient Disorders and Nutrient Management. Potash and Phosphate Institute of Canada and International Rice Research Institute. Los Banos.
- Evelin H., T.S. Devi, S. Gupta, R. Kapoor. 2019. Mitigation of salinity stress in plants by arbuscular mycorrhizal symbiosis: current understanding and new challenges. Front. Plant Sci. 10: 470.
- Flowers, T.J. & T.D. Colmer. 2008. Salinity tolerance in halophytes. New Phytologist. 179: 945-963.
- FAO. 2018. OECD-FAO Agricultural Outlook 2018-2027. Chapter 3: Cereals. (internet). http://www.fao.org/publications/oecd-fao-agricultural_outlook_2018-2027/en/. (diakses 15 November 2019).
- Fileccia V, P. Ruisi, R. Ingraffia, D. Giambalvo, A.S. Frenda & F. Martinelli. 2017. Arbuscular mycorrhizal symbiosis mitigates the negative effects of salinity on durum wheat. PLoS ONE 12 (9): e0184158.
- Ghafoor A, M. Qadir & G. Murtaza. 2004. Salt-Affected Soils: Principles of Management. 1st ed. Allied Book Centre, Lahore.
- Gardner, F.P, R.B. Pearce, & R.L. Mitchell. 1991. Physiology of Crop Plant (Fisiologi Tanaman Budidaya, alih bahasa: D.H. Goenadi). Gadjah Mada University Press, Yogyakarta.



- George, E., K. Haussler, S.K. Kothari & X.L. Li. 1992. Contribution of mychorrhizal hyphae to nutrient and water uptake of plants. In: D.J. Read, D.H. Lewis, A.H. Fitter, I.J. Alexander (Eds.). Mycorrhizas in ecosystems. CABI. UK.
- Gu, D., F. Zhen, D.B. Hannaway, Y. Zhu, L. Liu, W. Cao & L. Tang. 2017. Quantitative classification of rice (*Oryza sativa L.*) root length and diameter using Image Analysis. PLoS ONE. 12(1): e0169968.
- Hashem A., Abd_Allah E.A., Alqarawi A.A., Wirth S., Egamberdieva D. 2019. Comparing symbiotic performance and physiological responses of two soybean cultivars to arbuscular mycorrhizal fungi under salt stress. Saudi Journal of Biological Sciences. 26(1): 38-48.
- Isayenkov S.V. & F.J.M Maathuis. 2019. Plant salinity stress: many unanswered questions remain. Front. Plant Sci. 10:80.
- Jensen, C.R., V.O. Mongensen, G. Mortesen, M.N. Andersen, J.K Schjoerring, J.H. Thange & J. Koribidis, 1996. Leaf photosynthesis and drought adaption in field-grown oilseed rape (*Brassica napus L.*). Aust. J. Plant Physiol 23: 631-644.
- Kementan. 2018. Statistik Pertanian 2017. (buku elektronik). <http://epublikasi.setjen.pertanian.go.id/download/file/438-statistik-pertanian-2018>. (diakses: 15 Desember 2019).
- Kobae, Y., H. Kameoka, Y. Sugimura, K. Saito, R. Ohtomo, T. Fujiwara & J. Kyozuka. 2018. Strigolactone biosynthesis genes of rice are required for the punctual entry of arbuscular mycorrhizal fungi into the roots. Plant and Cell Physiology. 59(3): 544–553.
- Laei, G., M. H. Khajehzadeh, H. Afshari, A. G. Ebadi, H. Abbaspour. 2011. Effect of mycorrhiza symbiosis on the NaCl salinity in Sorghum bicolor. African Journal of Biotechnology. 10(40): 7796-7804.
- Ma N.L., W.A. Che Lah , N. Abd Kadir, M. Mustaqim, Z. Rahmat, A. Ahmad, S.D. Lamm & M.R. Ismail. 2018. Susceptibility and tolerance of rice crop to salt threat: Physiological and metabolic inspections. PLoS ONE. 13(2): e0192732.
- Maathuis F.J.M., T.J. Flowers, A.R. Yeo. 1992. Sodium chloride compartmentation in leaf vacuoles of the halophytes *Suaeda maritama* (L.) Dum. and its relation to tonoplast permeability. J. Exp. Bot. 43: 1219–1223.
- Machado, R.M.A & R.P. Serralheiro. 2017. Soil salinity: Effect on vegetable crop growth. Management practices to prevent and mitigate soil salinization. Horticulturae. 3(30): 1-13.
- Marwanto, S., A. Rachman, D. Erfandi, & I.G.M. Subiksa. 2009. Tingkat salinitas tanah pada lahan sawah intensif di Kabupaten Indramayu, Jawa Barat.



Dalam: U. Kurnia, F. Agus, D. Setyorini, dan A. Setiyanto (Eds). Pros. Sem. Nas. Multifungsi dan Konversi Lahan Pertanian. Balai Penelitian Tanah. Bogor. 175–190.

Metternicht, G.I. & J.A. Zinck. 2003. Remote sensing of soil salinity: potentials and constraints. *Remote Sensing of Environment*. 85(1): 1-20.

Miller R.M., J.D. Jastrow. 2000. Mycorrhizal fungi influence soil structure. In: Y. Kapulnik, D.D. Douds (Eds.). *Arbuscular Mycorrhizas: Physiology and Function*. Springer. Dordrecht. 3-18.

Moradi F. & A.M. Ismail. 2007. Responses of photosynthesis, chlorophyll fluorescence and ROS-scavenging systems to salt stress during seedling and reproductive stages in rice. *Annals of Botany*. 99: 1161–1173.

Munns, R., S. Husain, A.R. Rivelli, R.A. James, A.G. Condon. M.P. Lindsay, E.S. Lagudah, D.P. Schachtman & R.A. Hare. 2002. *Plant and Soil*. 247: 93-105.

Murayama. 1995. Development and senescence of an individual plant. In: T. Matsuo, K. Kumazawa, R. Ishii, K. Ishihara and H. Hirata (Eds.). *Science of the rice plant: Physiology*, Volume 2. Food and Agriculture Policy Research Center. Tokyo. 119–178.

Nam, K.H., H.J. Shin, I.S. Pack & C.G. Kim. 2018. Changes in metabolic profile and nutritional composition of rice in response to NaCl stress. *Korean Journal of Agriculture Science*. 45(2): 154-168.

Ogle, D. 2010. Plants for saline to sodic soil conditions. USDA-Natural Resources Conservation Service. Technical note no.9A. 10 p.

Ortas, I. & Ç. Akpinar. 2011. Response of maize genotypes to several mycorrhizal inoculums in terms of plant growth, nutrient uptake and spore production. *Journal of Plant Nutrition*. 34(7): 970-987.

Richards, L. A. (ed). 1954. *Diagnosis and Improvement of saline and Alkali Soils*. U.S. Dept. Agr. Handbook No. 60. 160 p.

Parvin S., M. Van Geel, T. Yeasmin, E. Verbruggen & O. Honnay. 2020. Effects of single and multiple species inocula of arbuscular mycorrhizal fungi on the salinity tolerance of a Bangladeshi rice (*Oryza sativa L.*) cultivar. *Mycorrhiza*. 30: 431–444.

Peuke, A.D. & W.D. Jeschke. 1999. The characterization of inhibition of net nitrate uptake by salt in salt-tolerance barley (*Hordeum vulgare L.* cv. California Mariout). *Jour. Exp. Bot.* 50(337): 1365-1372.

Porcel R., R. Aroca & J.M. Ruiz-Lozano. 2012. Salinity stress alleviation using arbuscular mycorrhizal fungi: A review. *Agron. Sustain. Dev.* 32(1):181-200.



- Porcel, R., S. Redondo-Gómez, E. Mateos-Naranjob, R. Aroca, R. Garciac & J. M. Ruiz-Lozano. 2015. Arbuscular mycorrhizal symbiosis ameliorates the optimum quantum yield of photosystem II and reduces non-photochemical quenching in rice plants subjected to salt stress. *Journal of Plant Physiology.* 185: 75–83
- Porcel, R., R. Aroca, R. Azcon & J. M. Ruiz-Lozano. 2016. Regulation of cation transporter genes by the arbuscular mycorrhizal symbiosis in rice plants subjected to salinity suggests improved salt tolerance due to reduced Na⁺root-to-shoot distribution. *Mycorrhiza.* 26:673–684.
- Prabowo, R. I. 2016. Pengaruh struktur kulit dan peningkatan hasil buah pisang “ambon kuning” dengan aplikasi magnesium, boron dan silikon. Skripsi. Fakultas Pertanian UGM.
- Rachman, A., Wahyunto & F. Agus. 2005. Integrated management for sustainable use of tsunami-affected land in Indonesia. Paper presented at the Mid-Term Workshop on Sustainable Use of Problem Soils in Rainfed Agriculture, Khon Khaen, 14-18 April 2005.
- Ram, L.C. 1980. Cation exchange capacity of plant roots in relation to nutrients uptake by shoot and grain as influenced by age. *Plant Soil.* 55: 215–224.
- Sairam, R.K., P.S. Deshmukh & D.S. Shukla. 1997. Tolerance to drought and temperature stress in relation to increased antioxidant enzyme activity in wheat. *J Agron Crop Sci.* 178(3): 171-178.
- Seelig, B.D. 2000. Salinity and sodicity in North Dakota soils. EB 57. North Dakota State University Extension Service. Fargo, North Dakota.
- Shabala, S. & T.A. Cuin. 2007. Potassium transport and plant salt tolerance. *Physiologia Plantarum.* 133: 651–669.
- Shabala, S. and R. Munns. 2012. Salinity stress: Physiological constraints and adaptive mechanism. In: S. Shabala (Ed.). *Plant Stress Physiology.* CABI. UK.
- Sheng, M., M. Tang, F. Zhang, Y. Huang. 2011. Influence of arbuscular mycorrhiza on organic solutes in maize leaves under salt stress. *Mycorrhiza.* 21: 423-430.
- Siregar, H. 1987. Budidaya Tanaman Padi di Indonesia. Sastra Hudayana. Jakarta.
- Smith, S.E. & D.J. Read (Eds.). 2008. *Mycorrhizal symbiosis.* Academic Press, Inc. San Diego.
- Soepandi, D. 2013. Fisiologi Adaptasi Tanaman terhadap Cekaman Abiotik pada Agroekosistem Tropika. IPB Press. Bogor.



- Son Y., K. Stott, D.A.C. Manning, J.M. Cooper. 2021. Carbon sequestration in artificial silicate soils facilitated by arbuscular mycorrhizal fungi and glomalin-related soil protein. *Eur J Soil Sci.* 72: 863-870.
- Staple R.C. & G.H. Toennissen. 1984. Salinity tolerance in plant: strategies for crop improvement. Wiley. New York.
- Sulistiono, W., Taryono, P. Yudono & Irham. 2017. Sugarcane roots dynamics inoculated with arbuscular mychorrhizal fungi on dry land. *J. Agron.* 16:101-114.
- Sultana N., T. Ikeda, R. Itoh. 1999. Effect of NaCl salinity on photosynthesis and dry matter accumulation in developing rice grains. *Environmental and Experimental Botany.* 42: 211–220.
- Talaat N.B. & B.T. Shawky. 2012. Influence of arbuscular mycorrhizae on root colonization, growth and productivity of two wheat cultivars under salt stress. *Archives of Agronomy and Soil Science.* 58(1): 85-100.
- Taiz, L. & E. Zeiger. 2002. *Plant Physiology.* 3rd edition. Sinauer Associates. Sunderland
- Thohiron, M. & H. Prasetyo. 2012. Pengelolaan Lahan dan Budidaya Tanaman Lahan Terdampak Lumpur Marine Sidoarjo. *J-PAL.* 3(1): 19-27.
- Wang, Z.G., Y.L. Bi, B. Jiang, Y. Zhakypbek, S.P. Peng, W.W. Liu, H. Liu. 2016. Arbuscular mycorrhizal fungi enhance soil carbon sequestration in the coalfields, northwest China. *Nature.* 6: 34336
- Wang F., Y. Sun & Z. Shi. 2019a. Arbuscular mycorrhiza enhances biomass production and salt tolerance of sweet sorghum. *Microorganisms.* 7:289.
- Wang J., Z. Fu, Q. Ren, L. Zhu, J. Lin, J. Zhang, X. Cheng, J. Ma & J. Yue. 2019b. Effects of arbuscular mycorrhizal fungi on growth, photosynthesis, and nutrient uptake of *Zelkova serrata* (Thunb.) Makino seedlings under salt stress. *Forests.* 10: 186.
- Wu N., Z. Li, H. Liu & M. Tang. 2015. Influence of arbuscular mycorrhiza on photosynthesis and water status of *Populus cathayana* Rehder males and females under salt stress. *Acta Physiol Plant.* 37: 183.
- Yamato M., S. Ikeda & K. Iwase. 2008. Community of arbuscular mycorrhizal fungi in a coastal vegetation on Okinawa Island and effect of the isolated fungi on growth of sorghum under salt-treated conditions. *Mycorrhiza.* 18: 241–249.
- Yamauchi, A., Y. Kono & J. Tatsumi. 1987. Quantitative analysis on root system structures of upland rice and maize. *Japan. Jour. Crop Sci.* 56(4): 608-617.
- Yoshida, S. 1975. Factor that limit the growth and yield of upland rice. Major Research in Upland Rice. International Rice Research Institute. Los Banos. 46-71.



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PENGARUH APLIKASI MIKORIZA ARBUSKULAR TERHADAP KARAKTERISTIK FISIOLOGI

PERTUMBUHAN DAN HASIL PADI

GOGO (*Oryza sativa L.*) YANG TERCEKAM SALINITAS

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Yoshida, S. 1981. Fundamentals of Rice Crop Science. International Rice Research Institute. Los Banos.

Zeng, L. & M.C. Shannon. 2000. Effects of salinity on grain yield and yield components of rice at different seeding densities. Agron. J. 92:418–423.

Zhang, Z., Q. Liu, H. Song, X. Rong, A.M. Ismail. 2012. Responses of different rice (*Oryza sativa L.*) genotypes to salt stress and relation to carbohydrate metabolism and chlorophyll content. Afr. J. Agric. Res. 7(1): 19-27.