

CHAPTER 4

CLEANER PRODUCTION PRACTICE RECOMMENDATIONS IN THE AGRICULTURE SECTOR: LITERATURE REVIEW

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1. INTRODUCTION

Archaeologists determine the history of agricultural production by radiocarbon testing the carbonaceous materials found because of excavation. Because of this method, they state that agricultural production on earth has emerged in nine regions at different times independently/dependently. These; Fertile Crescent, China, Mesoamerica, Andes and Amazon Region, Eastern United States, Sahel, Tropical West Africa, Ethiopia, and New Kyrenia (Diamond, 2018). According to the vegetative, animal, and climatic conditions of these regions, the earliest date was found in the Fertile Crescent of Mesopotamia, which includes today's Iraq, Turkey, Syria, and Jordan, approximately B.C. It starts around 10,000. Over time, with the population becoming more settled and living on farms, abundant agricultural products have been planted and harvested (Kisley et al., 2004; Tudi et al., 2021). However, especially since the 1950s, the rapid increase in the world population (Gu et al., 2021) has increased the demand for food

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- It is critical to integrate new technology into agricultural production and to help implementers financially.

REFERENCES

- Abbas, S., 2022. Global warming and export competitiveness of agriculture sector: evidence from heterogeneous econometric analysis of Pakistan. *Environmental Science and Pollution Research*, 29(23):34325-34337. <https://doi.org/10.1007/s11356-022-18562-y>
- Abdel-Aziz, H.M.M., Hasaneen, M.N.A., Omer, A.M., 2016. Nano chitosan-NPK fertilizer enhances the growth and productivity of wheat plants grown in sandy soil. *Spanish J Agric Res* 14: 1–9. <http://dx.doi.org/10.5424/sjar/2016141-8205>.
- Acosta-Silva, Y.D.J., Torres-Pacheco, I., Matsumoto, Y., Toledo-Ayala, M., Soto-Zarazúa, G. M., Zelaya-Ángel, O., & Méndez-López, A., 2019. Applications of solar and wind renewable energy in agriculture: A review. *Science Progress*, 102(2):127-140. <https://doi.org/10.1177/0036850419832696>
- Alkaya, E., Demirer, G.N., 2015. Sectoral assessment of the Turkish textile industry for the diffusion of sustainable production approach. *The Journal of The Textile Institute*, 106(11):1212-1225. <https://www.tandfonline.com/doi/pdf/10.1080/00405000.2014.985880>
- Athira, G., Bahurudeen, A., & Appari, S., 2019. Sustainable alternatives to carbon intensive paddy field burning in India: A framework for cleaner production in agriculture, energy, and construction industries. *Journal of cleaner production*, 236, 117598. <https://doi.org/10.1016/j.jclepro.2019.07.073>
- Bernardes, M. F. F., Pazin, M., Pereira, L. C., & Dorta, D. J., 2015. Impact of pesticides on environmental and human health. *Toxicology studies-cells, drugs and environment*, 195-233. <https://dx.doi.org/10.5772/59710>
- Case, L., Mendicino, L., Thomas, D., 1995. Developing and maintain a pollution prevention program. In: Freeman, H.M. (Ed.), *Industrial Pollution Prevention Handbook*. McGraw-Hill, New York, pp. 99e120.
- CEBDS (Brazilian Business Council for Sustainable Development), 2003. Guia daprodução mais Limpaefaca você mesmo. <http://www.pmaisl.com.br/publicacoes/guia-da-pmaisl.pdf> (accessed 16.01.12. by Lopes Silva et al., 2013).
- CETESB (Company of Environmental Sanitation Technology of the Sao Paulo State), 2002. Manual para implementação de um programa de Prevenção à Poluição,fourthed.. http://www.cetesb.sp.gov.br/tecnologia/producao_limpa/documentos/manual_implem.pdf (accessed 16.01.12. by Lopes Silva et al., 2013).
- Christensen, T., Pedersen, A. B., Nielsen, H. O., Mørkbak, M. R., Hasler, B., & Denver, S., 2011. Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—A choice experiment study. *Ecological economics*, 70(8): 1558-1564. <https://doi.org/10.1016/j.ecolecon.2011.06.011>

- ecolecon.2011.03.021
- Environment Canada, 2009. Pollution Prevention Handbook. <http://www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=456875F44-1> (accessed 31.08.12. by Lopes Silva et al., 2013)
- da Silva, P.C., de Oliveira, Neto, G.C., Correia, J.M.F., Tucci, H.N.P., 2021. Evaluation of economic, environmental and operational performance of the adoption of cleaner production: Survey in large textile industries. *Journal of Cleaner Production*, 278, 123855. <https://doi.org/10.1016/j.jclepro.2020.123855>
- de Oliveira Neto, G. C, Correia, J.M.F., Silva, P. C, de Oliveira Sanches, A.G., Lucato, W.C., 2019. Cleaner Production in the textile industry and its relationship to sustainable development goals. *Journal of cleaner production*, 228:1514-1525. <https://doi.org/10.1016/j.jclepro.2019.04.334>
- Dhawan, V., 2017. Water and agriculture in India. In Background paper for the South Asia expert panel during the Global Forum for Food and Agriculture (Vol. 28).
- Diamond, J., 2018. Tüfek, Mikrop ve Çelik. ISBN:978-605-299-457-3
- Fan, X., Zhang, W., Chen, W., & Chen, B., 2020. Land–water–energy nexus in agricultural management for greenhouse gas mitigation. *Applied Energy*, 265, 114796. <https://doi.org/10.1016/j.apenergy.2020.114796>
- Garcia, D. J., Lovett, B. M., You, F., 2019. Considering agricultural wastes and ecosystem services in Food-Energy-Water-Waste Nexus system design. *Journal of cleaner production*, 228, 941-955. <https://doi.org/10.1016/j.jclepro.2019.04.314>.
- Giroto, A. S., Guimarães, G. G. F., Foschini, M., & Ribeiro, C., 2017. Role of slow-release nanocomposite fertilizers on nitrogen and phosphate availability in soil. *Sci Rep* 7: 46032. <http://dx.doi.org/10.1038/srep46032>
- Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., ... & Toulmin, C., 2010. Food security: the challenge of feeding 9 billion people. *science*, 327(5967):812-818. DOI: 10.1126/science.1185383
- Gray, N. F., 1994. Drinking water quality: problems and solutions. John Wiley & Sons. ISBN:9780471948179. Chichester / UK.
- Gu, D., Andreev, K., & Dupre, M. E., 2021. Major trends in population growth around the world. *China CDC weekly*, 3(28):604. doi: 10.46234/cco-cw2021.160
- Hussain, T., Wahab, A., 2018. A Critical Review Of The Current Water Conservation Practices In Textile Wet Processing. *Journal Of Cleaner Production*, 198: 806-819. <https://doi.org/10.1016/j.jclepro.2018.07.051>
- Ikram, M., Ferasso, M., Sroufe, R., & Zhang, Q., 2021. Assessing green technology indicators for cleaner production and sustainable investments in a developing country context. *Journal of Cleaner Production*, 322, 129090. <https://doi.org/10.1016/j.jclepro.2021.129090>
- Karamian, F., Mirakzadeh, A. A., & Azari, A., 2021. The water-energy-food nexus in farming: Managerial insights for a more efficient consumption of

- agricultural inputs. Sustainable Production and Consumption, 27: 1357-1371. <https://doi.org/10.1016/j.spc.2021.03.008>
- Khan, Z., 2008. Cleaner production: an economical option for ISO certification in developing countries. Journal of cleaner production, 16(1): 22-27. <https://doi.org/10.1016/j.jclepro.2006.06.007>
- Kislev, M. E., Weiss, E., & Hartmann, A., 2004. Impetus for sowing and the beginning of agriculture: ground collecting of wild cereals. Proceedings of the National Academy of Sciences, 101(9): 2692-2695. <https://doi.org/10.1073/pnas.0308739101>
- Kopittke, 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. <https://doi.org/10.1039/C9EN00971J>
- Lateef, A., Nazir, R., Jamil, N., Alam, S., Shah, R., Khan, M. N., & Saleem, M., 2019. Synthesis and characterization of environmental friendly corn cob biochar based nano-composite-A potential slow release nano-fertilizer for sustainable agriculture. Environmental Nanotechnology, Monitoring & Management, 11, 100212. <https://doi.org/10.1016/j.enmm.2019.100212>
- Mikulčić, H., Baleta, J., & Klemeš, J. J., 2022. Cleaner technologies for sustainable development. Cleaner Engineering and Technology, 7, 100445. <https://doi.org/10.1016/j.clet.2022.100445>
- Mwalupaso, G. E., Korotoumou, M., Eshetie, A. M., Alavo, J. P. E., & Tian, X., 2019. Recuperating dynamism in agriculture through adoption of sustainable agricultural technology-Implications for cleaner production. Journal of Cleaner Production, 232: 639-647. <https://doi.org/10.1016/j.jclepro.2019.05.366>
- Nunes, J. R. R., da Silva, J. E. A. R., da Silva Moris, V. A., & Giannetti, B. F., 2019. Cleaner Production in small companies: Proposal of a management methodology. Journal of Cleaner Production, 218:357-366. <https://doi.org/10.1016/j.jclepro.2019.01.219>
- Nyasimi, M., Amwata, D., Hove, L., Kinyangi, J., & Wamukoya, G., 2014. Evidence of impact: climate-smart agriculture in Africa. CCAFS Working Paper No. 86. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
- Pojasek, R. B., 2002. Merging pollution prevention into quality. Environmental Quality Management, 11(3):85-85. <https://doi.org/10.1002/tqem.10032>
- Rahman, M. H., Haque, K. S., & Khan, M. Z. H., 2021. A review on application of controlled released fertilizers influencing the sustainable agricultural production: A Cleaner production process. Environmental Technology & Innovation, 23, 101697. <https://doi.org/10.1016/j.eti.2021.101697>
- Rütting, T., Aronsson, H., & Delin, S., 2018. Efficient use of nitrogen in agriculture. Nutrient cycling in Agroecosystems, 110(1), 1-5. <https://doi.org/10.1007/s10705-017-9900-8>
- Shen, T.T., 1995. Industrial Pollution Prevention. Springer, Berlin. DOI:

- 10.1007/978-3-662-03110-0_2
- Silva, D. A. L., Delai, I., de Castro, M. A. S., & Ometto, A. R., 2013. Quality tools applied to Cleaner Production programs: a first approach toward a new methodology. *Journal of Cleaner Production*, 47: 174-187. <https://doi.org/10.1016/j.jclepro.2012.10.026>.
- Singh, A., 2018. Managing the environmental problems of irrigated agriculture through the appraisal of groundwater recharge. *Ecological indicators*, 92: 388-393. <https://doi.org/10.1016/j.ecolind.2017.11.065>.
- Singh, R. B., Shastun, S., Chibisov, S., Itharat, A., De Meester, F., Wilson, D. W., & Halabi, G., 2016. Functional food security and the heart. *Journal of Cardiology and Therapy*, 4(1):599-607. doi: 10.17554/j.issn.2309-6861.2017.04.125.
- Skaf, L., Buonocore, E., Dumontet, S., Capone, R., & Franzese, P. P., 2019. Food security and sustainable agriculture in Lebanon: An environmental accounting framework. *Journal of cleaner production*, 209:1025-1032. <https://doi.org/10.1016/j.jclepro.2018.10.301>.
- Soares, W. L., & de Souza Porto, M. F., 2009. Estimating the social cost of pesticide use: an assessment from acute poisoning in Brazil. *Ecological Economics*, 68(10):2721-2728. <https://doi.org/10.1016/j.ecolecon.2009.05.008>.
- Stone, L., 2000. When case studies are not enough: the influence of corporate culture and employee attitudes on the success of cleaner production initiatives. *Journal of Cleaner Production*, 8(5):353-359. [https://doi.org/10.1016/S0959-6526\(00\)00037-8](https://doi.org/10.1016/S0959-6526(00)00037-8).
- Styger, E., Uphoff, N., 2016. The System of Rice Intensification (SRI): Revisiting agronomy for a changing climate. CSA Practice Brief. <https://hdl.handle.net/10568/77040>.
- Styger, E., Aboubacrine, G., Attaher, M. A., & Uphoff, N., 2011. The system of rice intensification as a sustainable agricultural innovation: introducing, adapting and scaling up a system of rice intensification practices in the Timbuktu region of Mali. *International Journal of Agricultural Sustainability*, 9(1): 67-75. <https://doi.org/10.3763/ijas.2010.0549>.
- Sutton, M. A., Oenema, O., Erisman, J. W., Leip, A., van Grinsven, H., & Wiñiwarter, W., 2011. Too much of a good thing. *Nature*, 472(7342): 159-161. <https://doi.org/10.1038/472159a>
- Tan, S., S., 2019. Kırsal yoksulluk ve sübvansiyonlar: tarımsal girdi sübvansiyonları açısından bir değerlendirme. Cataloging-In-Publication Data, 727.
- Tarafder, C., Daizy, M., Alam, M. M., Ali, M. R., Islam, M. J., Islam, R., ... & Khan, M. Z. H., 2020. Formulation of a hybrid nanofertilizer for slow and sustainable release of micronutrients. *ACS omega*, 5(37): 23960-23966. <https://doi.org/10.1021/acsomega.0c03233>
- Thakur, A. K., Uphoff, N. T., & Stoop, W. A., 2016. Scientific Underpinnings of the System of Rice Intensification (SRI): What is known so far?. *Advances in agronomy*, 135: 147-179. <https://doi.org/10.1016/bs.agron.2015.09.004>.
- Tian, H., Lu, C., Ciais, P., Michalak, A. M., Canadell, J. G., Saikawa, E., ... & Wof-

- sy, S. C., 2016. The terrestrial biosphere as a net source of greenhouse gases to the atmosphere. *Nature*, 531(7593):225-228. <https://doi.org/10.1038/nature16946>.
- Tripathi, A. D., Mishra, R., Maurya, K. K., Singh, R. B., & Wilson, D. W., 2019. Estimates for world population and global food availability for global health. In *The role of functional food security in global health* (pp. 3-24). Academic Press. <https://doi.org/10.1016/B978-0-12-813148-0.00001-3>.
- Tudi, M., Daniel Ruan, H., Wang, L., Lyu, J., Sadler, R., Connell, D., ... & Phung, D. T., 2021. Agriculture development, pesticide application and its impact on the environment. *International journal of environmental research and public health*, 18(3): 1112. <https://doi.org/10.3390/ijerph18031112>
- UNEP, 2015. The United Nations Environment Programme And The 2030 Agenda. *Global Action For People And The Planet*. 8. <https://wedocs.unep.org/20.500.11822/9851>
- UNEP DTIE (United Nations Environmental Programme, Division of Technology, Industry and Environment), 1996. Cleaner Production Resource Training Package, first ed. United Nations Publication, Paris.
- UNEP/UNIDO, 2017. UNEP/UNIDO Guidance Manual Guidance Manual: How to Establish and Operate Cleaner Production Centres. <https://open.unido.org/api/documents/4802268/download/Guidance%20Manual%20-%20How%20to%20Establish%20and%20Operate%20Cleaner%20Production%20Centres> (accessed 03.10.2022).
- UNIDO (United Nations industrial development organization), 2002. Manual on the Development of Cleaner Production Policies Approaches and Instruments. Guidelines for National Cleaner Production Centres and Programmes. http://www.unido.org/fileadmin/import/9750_0256406e.pdf (accessed 03.10.2022)
- Uphoff, N., Kassam, A., & Harwood, R., 2011. SRI as a methodology for raising crop and water productivity: productive adaptations in rice agronomy and irrigation water management. *Paddy and Water Environment*, 9(1): 3-11. <https://doi.org/10.1007/s10333-010-0224-4>.
- USEPA (United States Environmental Protection Agency), 1998. Principles of Pollution Prevention and Cleaner Production: An International Training Course (Participant's Manual). <http://recp.ge/wp-content/uploads/2015/12/POLLUTION-PREVENTION-AND-CLEANER-PRODUCTION-EPA.pdf> (accessed 03.10.2022).
- Wang, B., Zhang, S., Guo, L., Klemeš, J. J., & Varbanov, P. S., 2022. Graphical approaches for cleaner production and sustainability in process systems. *Journal of Cleaner Production*, 132790. <https://doi.org/10.1016/j.jclepro.2022.132790>.
- Wang, H., Liu, C., & Zhang, L., 2002. Water-saving agriculture in China: An Overview. [https://doi.org/10.1016/S0065-2113\(02\)75004-9](https://doi.org/10.1016/S0065-2113(02)75004-9).
- Xin, X., Judy, J. D., Sumerlin, B. B., & He, Z., 2020. Nano-enabled agriculture: from nanoparticles to smart nanodelivery systems. *Environmental Che-*

- mistry, 17(6):413-425. <https://doi.org/10.1071/EN19254>.
- Zhang, L., Li, X., Yu, J., & Yao, X., 2018. Toward cleaner production: what drives farmers to adopt eco-friendly agricultural production?. *Journal of cleaner production*, 184:550-558. <https://doi.org/10.1016/j.jclepro.2018.02.272>.
- Zhang, T., Yang, Y., Ni, J., & Xie, D., 2019. Adoption behavior of cleaner production techniques to control agricultural non-point source pollution: A case study in the Three Gorges Reservoir Area. *Journal of cleaner production*, 223:897-906. <https://doi.org/10.1016/j.jclepro.2019.03.194>.