RETASTE Conference Abstracts
Vol. 3 RETASTE-LCA-539-Poster
Athens, Greece, 27-29 September, 2023

rethink food resources, losses, and waste 2023 retaste

Comparison of Alternative Life Cycle Assessment Scenarios for the Management of Pruning Residues and Wastewater of Olive Oil Production

[1]Katerina Katrini, [2]Vasiliki Kalogerakou, [3]Asfra Rizwan Toor, [1]Ioannis Daliakopoulos, [2]Ioannis Mavrogiannis and [4]Thrassyvoulos Manios

[1]*Department of Agriculture, Hellenic Mediterranean University, 71410 Heraklion, Greece*
[2]*Anelixis Consulting Development, 713 06 Heraklion, Greece*
[3]*Sustainable Development Study Centre, Government College University Lahore, 54000, Pakistan*
[4]*Department of Agriculture, Hellenic Mediterranean University, 71410 Heraklion, Greece; TM Solutions, 71409 Heraklion, Greece*

Abstract

Sustainable management of olive oil production waste, constituting mainly of pruning residues and olive mill wastewater, as soil amendments (Galliou et al., 2018; Manios, 2004; Manios et al., 2004, 1989) has multiple environmental benefits due to nutrient recycling and carbon sequestration, leading to reduced CO2 emissions (Ryals et al., 2015), combating of soil degradation and eventually climate smart soils (Paustian et al., 2016). Nevertheless, supply chain costing (Argo et al., 2013; Junginger et al., 2011) and waste accessibility problems (Esteban and Carrasco, 2011) are barriers against the widespread use of sustainable management practices like on-site composting, which drive land managers to sub-optimal or even prohibited practices such as pruning residue burning (Manios, 2004). In this context, the CompOlive project developed an on-site composting service that aims to overcome the accessibility and supply chain obstacles using remote sensing imagery to assess biomass availability (Fidani et al., 2023). The service is available to land managers through an online booking system and includes on-site chipping of residues, establishment of static aeration compost piles, and regular aeration and irrigation of the piles with olive mill wastewater. Here we assess the environmental footprint of the service and compare it against business-as-usual (i.e., burning olive tree pruning residues on-site and treating olive mill wastewater in evaporation ponds) and off-site treatment at a centralised composting facility. The Life Cycle Assessment was conducted in OpenLCA by modifying processes from the agribalyse (Colomb et al., 2015) and ecoinvent (Wernet et al., 2016) databases. The environmental footprint of the olive oil production waste end-of-life scenarios were calculated using ReCiPe (Dekker et al., 2020) at the midpoint and endpoint levels based on the selected impact categories. Results show that the carbon footprint of the new

service is 15-45% lower that that of business as usual, and roughly equivalent to off-site composting, without taking into account the benefits in land conservation.

Keywords: olive tree pruning residues, olive mill wastewater, compost, on-site treatment

References

Argo, A.M., Tan, E.C., Inman, D., Langholtz, M.H., Eaton, L.M., Jacobson, J.J., Wright, C.T., Muth, D.J., Wu, M.M., Chiu, Y.-W., Graham, R.L., 2013. Investigation of biochemical biorefinery sizing and environmental sustainability impacts for conventional bale system and advanced uniform biomass logistics designs. Biofuels, Bioproducts and Biorefining 7, 282–302. https://doi.org/10.1002/bbb.1391 Colomb, V., Ait Amar, S., Mens, C.B., Gac, A., Gaillard, G., Koch, P., Mousset, J., Salou, T., Tailleur, A., van der Werf, H.M.G., 2015. AGRIBALYSE ® , the French LCI Database for agricultural products: high quality data for producers and environmental labelling. OCL 22, D104. https://doi.org/10.1051/ocl/20140047 Dekker, E., Zijp, M.C., van de Kamp, M.E., Temme, E.H.M., van Zelm, R., 2020. A taste of the new ReCiPe for life cycle assessment: consequences of the updated impact assessment method on food product LCAs. International Journal of Life Cycle Assessment 25, 2315–2324. https://doi.org/10.1007/S11367-019-01653-3/FIGURES/5 Esteban, L.S., Carrasco, J.E., 2011. Biomass resources and costs: Assessment in different EU countries. Biomass Bioenergy 35, S21–S30. https://doi.org/10.1016/J.BIOMBIOE.2011.03.045 Fidani, S., Maroufidis, I., Chlorokostas, S., Daliakopoulos, I.N., Papadimitriou, D., Louloudakis, I., Daskalakis, G., Charalambopoulou, B., Manios, T., 2023. Comparison of three algorithms for tree crown area and available pruning biomass monitoring, in: EGU General Assembly 2023. Copernicus, Vienna. https://doi.org/https://doi.org/10.5194/egusphere-egu23-17144 Galliou, F., Markakis, N., Fountoulakis, M.S., Nikolaidis, N., Manios, T., 2018. Production of organic fertilizer from olive mill wastewater by combining solar greenhouse drying and composting. Waste Management 75, 305–311. https://doi.org/10.1016/j.wasman.2018.01.020 Junginger, M., van Dam, J., Zarrilli, S., Ali Mohamed, F., Marchal, D., Faaij, A., 2011. Opportunities and barriers for international bioenergy trade. Energy Policy 39, 2028–2042. https://doi.org/10.1016/j.enpol.2011.01.040 Manios, T., 2004. The composting potential of different organic solid wastes: experience from the island of Crete. Environ Int 29, 1079–1089. https://doi.org/10.1016/S0160-4120(03)00119-3 Manios, T., Maniadakis, K., Kalogeraki, M., Mari, E., Terzakis, S., Magiatis, P., Mikros, E., Agalias, A., Spanos, I., Manios, V., 2004. Cocomposting olive residuals and green waste on Crete. Manios, V.I., Tsikalas, P.E., Siminis, H.I., Verdonck, O., 1989. Phytotoxicity of olive tree leaf compost in relation to the organic acid concentration. Biological Wastes 27, 307–317. https://doi.org/10.1016/0269-7483(89)90011-6 Paustian, K., Lehmann, J., Ogle, S., Reay, D., Robertson, G.P., Smith, P., 2016. Climate-smart soils. Nature 532, 49–57. https://doi.org/10.1038/nature17174 Ryals, R., Hartman, M.D., Parton, W.J., DeLonge, M.S., Silver, W.L., 2015. Long-term climate change mitigation potential with organic matter management on grasslands. Ecological Applications 25, 531–545. https://doi.org/10.1890/13-2126.1 Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. International Journal of Life Cycle Assessment 21, 1218–1230. https://doi.org/10.1007/S11367-016-1087-8/FIGURES/7

Acknowledgments: This research is co-financed by the European Union and Greek national funds through the Operational Program CRETE 2014-2020, under Project “CompOlive: Integrated System for the Exploitation of Olive Cultivation Byproducts Soil Amendments” (KPHP3-0028773).