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Life-cycle assessment of irrigated and rainfed sunflower addressing uncertainty and land use change scenarios

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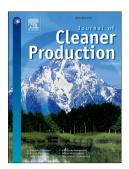
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10 **Abstract**

11 Sunflower is an important feedstock for food and energy purposes in southern European 12 countries. The main goal of this article is to present an environmental life-cycle assessment of sunflower cultivated in Portugal comparing irrigated and rainfed systems, 13 14 incorporating parameter uncertainty and assessing alternative land-use change scenarios. The functional unit adopted was 1 kg of sunflower seeds (hectare of land was also 15 addressed in a sensitivity analysis). The average productivity (kg ha⁻¹ year⁻¹) of irrigated 16 17 sunflower was 3.5 times higher than of rainfed. Irrigated sunflower presented higher 18 acidification impact than rainfed. Similar greenhouse gas intensity and eutrophication 19 impact were found for irrigated and rainfed systems taking into account the high variability 20 and uncertainty levels calculated. Higher uncertainty levels were observed for the impacts 21 of irrigated sunflower compared with rainfed, due to field emissions. Greenhouse gas 22 intensity of sunflower greatly depends on land use change scenarios (the lowest emissions 23 occur for the conversion of severely degraded grassland into irrigated sunflower and the highest emissions for the conversion of improved management grassland into rainfed 24 25 sunflower). The sensitivity analysis performed for the functional unit showed very different

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