CULTIVATION OF GOLDEN THISTLE (*SCOLYMUS HISPANICUS* L.) CAN SUPPORT LOW ENVIRONMENTAL FOOTPRINT AGRICULTURE AND FOOD SECURITY.

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Introduction

Sustainable development goals are highly linked to food systems and there is an urgent need to mitigate the environmental impact of food production (Kross et al. 2022). The integration of wild edible species in commercial farming systems has been suggested as a climate change mitigation measure. However, the environmental impact of such species is scarcely investigated. Research related to LCA and food production could be approached from the perspective of 1) production system, 2) crop and 3) system boundaries. Regarding production systems, low-input agriculture leads to reduced environmental damage both at local and global scale (Michos et al. 2018).

Materials and Methods

This study is the first to report environmental impact indicators of golden thistle cultivation (*Scolymus hispanicus L.*), using Life Cycle Assessment (LCA). The analysis was based on a field experiment and explored several scenarios (cradle to farm gate). For this work, information for cultivation was based on an experiment under different irrigation schemes, as well as in previous research (Petropoulos et al. 2019). This trial was conducted at the experimental farm of the University of Thessaly in Velestino (Greece; 39◦37'18.6'' N, 22◦22'55.1'' E) from October 2020 to April 2021. The inputs for 1000 kg of fresh product, for three irrigation treatments, are provided in Table 1.

***Table 1*. Inputs and yield for *Scolymus hispanicus* per 1 ha of field.**

	Treatments		
	Full irrigation	**70%**	**No irrigation**
Plants (number)	8444	8939	10974
Fertilizers (kg) (10-10-10 NPK)	21.1	22.3	27.4
Water (m^3)	702.6	520.6	0.0
Electricity (MJ)	17446.4	12927.5	0.0
tillage (h)	1.4	1.5	1.8
tillage (m^2)	2111	2111	2111
disc harrow (h)	1.1	1.1	1.4
disc harrow (m^2)	2111	2111	2111

Data on management practices such as soil cultivation, irrigation, energy, machinery, area of cultivated land and the use of fertilizers have been obtained and transformed per production of 1 ton of fresh product, based on the yield. Soil respiration was estimated using data from the literature which were included in the model. The RECIPE midpoint (H) impact assessment method was employed. The Open LCA Software (2.0.2) was used with the Agribalyse v3 database. The indicators of ***global warming (CO_2eq)***, ***water use (m^3)*** and ***energy (MJ)***, per 1 ton of product (FU) are only presented in this poster.

Results

In ***Figure 1***, boxplots are presented in the case of "cradle to farm gate" system boundaries for the impact categories: global warming (kg CO_2 eq) (Fig. 1a) water consumption (m^3) (Fig. 1b) and fossil resource scarcity (kg oil eq) (Fig. 1c), for scenarios 1-3 (Full irrigation, 70% of field capacity, no irrigation, respectively; see Table 1). The median values (5-95% percentiles) for global warming, water consumption and fossil resource scarcity, per 1000 kg of the final product (fresh weight) were 1554 (-660-3755) kg CO_2 eq, 704 (587-819) m^3 and 104 (87-126) kg oil eq, in the case of full irrigation. For 70% irrigation, these values were 1516 (-764-3820) kg CO_2 eq, 525 (439-608) m^3 and 95 (80-116) kg oil eq, for global warming, water consumption and fossil resource scarcity, respectively. Finally, for no irrigation global warming, water (virtual; scope 3) consumption and fossil resource scarcity, were 719 (-1486-2968) kg CO_2 eq, 1.9 (1.6-2.2) m^3 and 73 (54-99) kg oil eq, respectively.

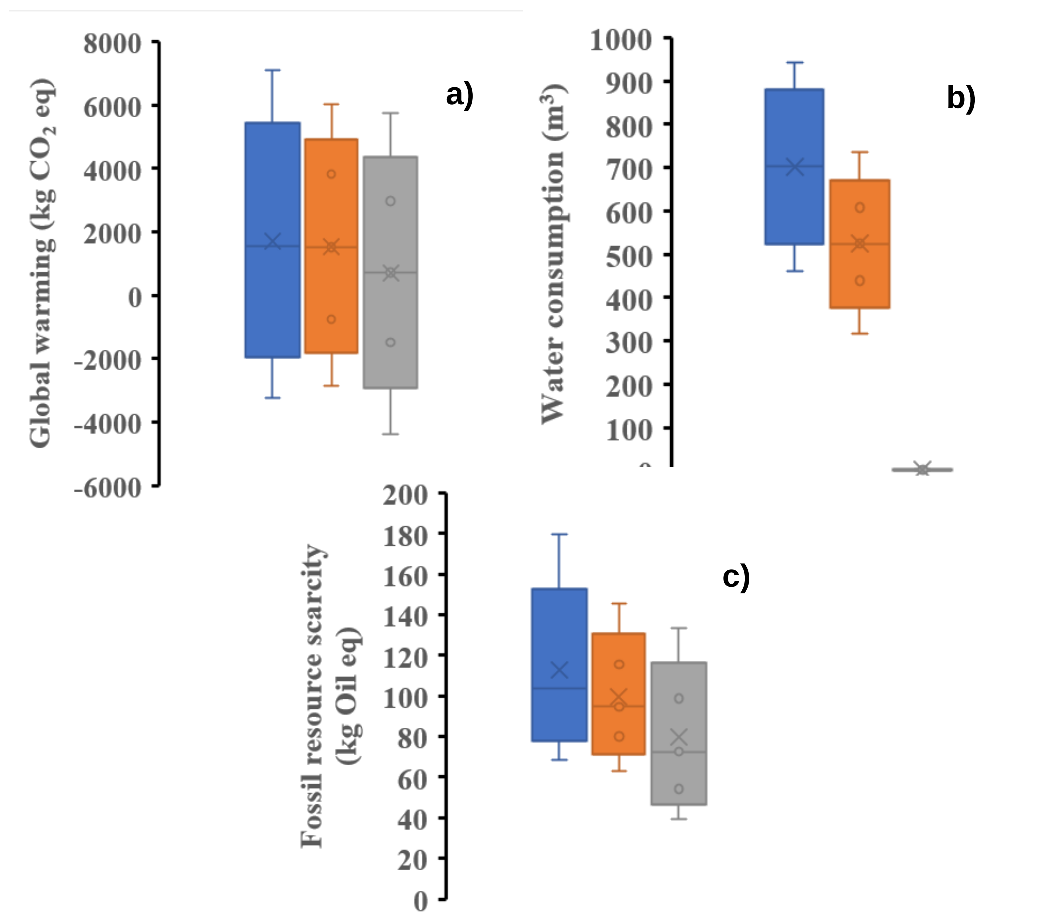

Figure 1. a) kg CO_2eq. b) water consumption (m^3) c) Energy used to expressed as kg oil eq, per ton of product fresh weight (cradle to farm gate)

Discussion

For the mitigation of the environmental impacts, the targets are the following:
1. Reduction of irrigation
2. Minimize fertilizers and soil cultivation.

Soil emissions (e.g., N_2O due to fertilizer application, NH_3 and heterotrophic respiration) appear to be the key to sustainable production and they are related to nutrient management, tillage practices, and the use of fertilizers and manure. Soil can also act as a sink for C storage, mitigating climate change and should be considered as a way to balance emissions due to inputs use for production (Litskas 2023).

Conclusions

This study is the first to report the environmental footprint of golden thistle (*Scolymus hispanicus*) cultivation, a wild edible species, using Life Cycle Assessment (LCA), under different production scenarios. Our results showed that golden thistle could be a valuable alternative from an environmental point of view, if cultivated under low inputs (e.g., non-irrigated).

References

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