ENVIRONMENTAL BENEFITS: TRADITIONAL VS INNOVATIVE PACKAGING FOR OLIVE OIL

Valentina Giovenzana, Andrea Casson, Roberto Beghi, Alessio Tugnolo, Silvia Grassi, Cristina Alamprese, Ernestina Casiraghi, Stefano Farris, Ilaria Fiorindo, Riccardo Guidetti

Department of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy, Università degli Studi di Milano, via Celoria, 2, 20133 Milano
Department of Food, Environmental and Nutritional Sciences, Università degli Studi di Milano, via Celoria, 2, 20133 Milano
*andrea.casson@unimi.it

Figure 1: Materials and percentage composition of the traditional packaging and the innovative packaging.

Problem definition

Plastic represents the engineering material of our ages, it has been using to substitute traditional materials like wood, glass and metal, in different shapes.
The largest part of plastics currently used in the food sector, as packaging applications, are made out of petroleum-derived materials. The non-renewable nature of these materials drives the packaging market to new and renewable alternatives, in line with the increasing consumers' demand for disposable, potentially biodegradable, and recyclable solutions. Bio-based plastics could be one of the most promising solutions to the impacts of non-renewable resources.

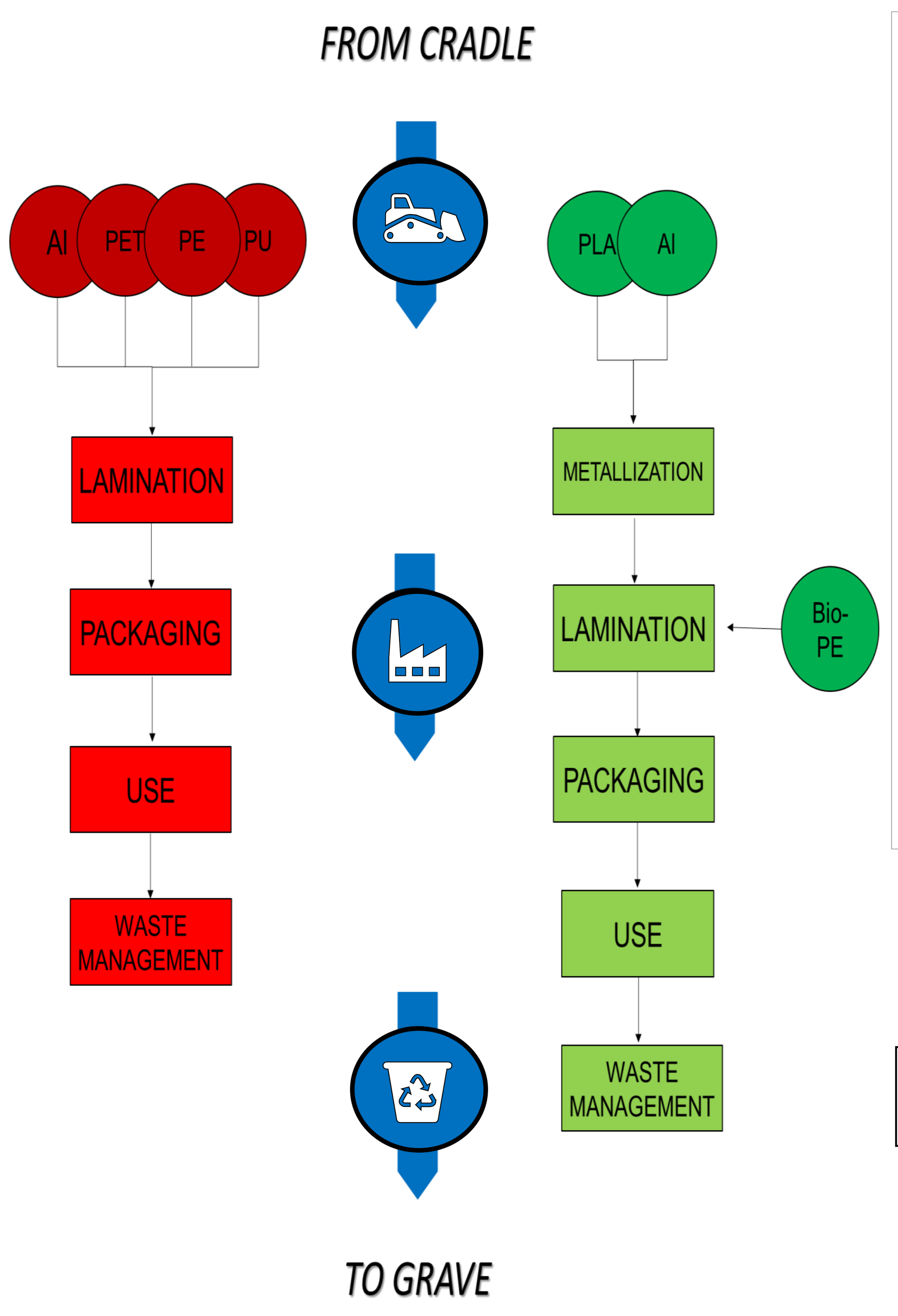
Goal

The aim of this study was to investigate the environmental performance of two different packaging solutions for extra virgin olive oil (one traditional and one innovative solution)

Method

Life cycle assessment (LCA) (ISO 14040:2006) was used as a tool to:

- Identify the environmental profiles of the two packaging.
- Highlight the most environmental damaging phases throughout the production.
- Make comparisons between the two packaging.



Results

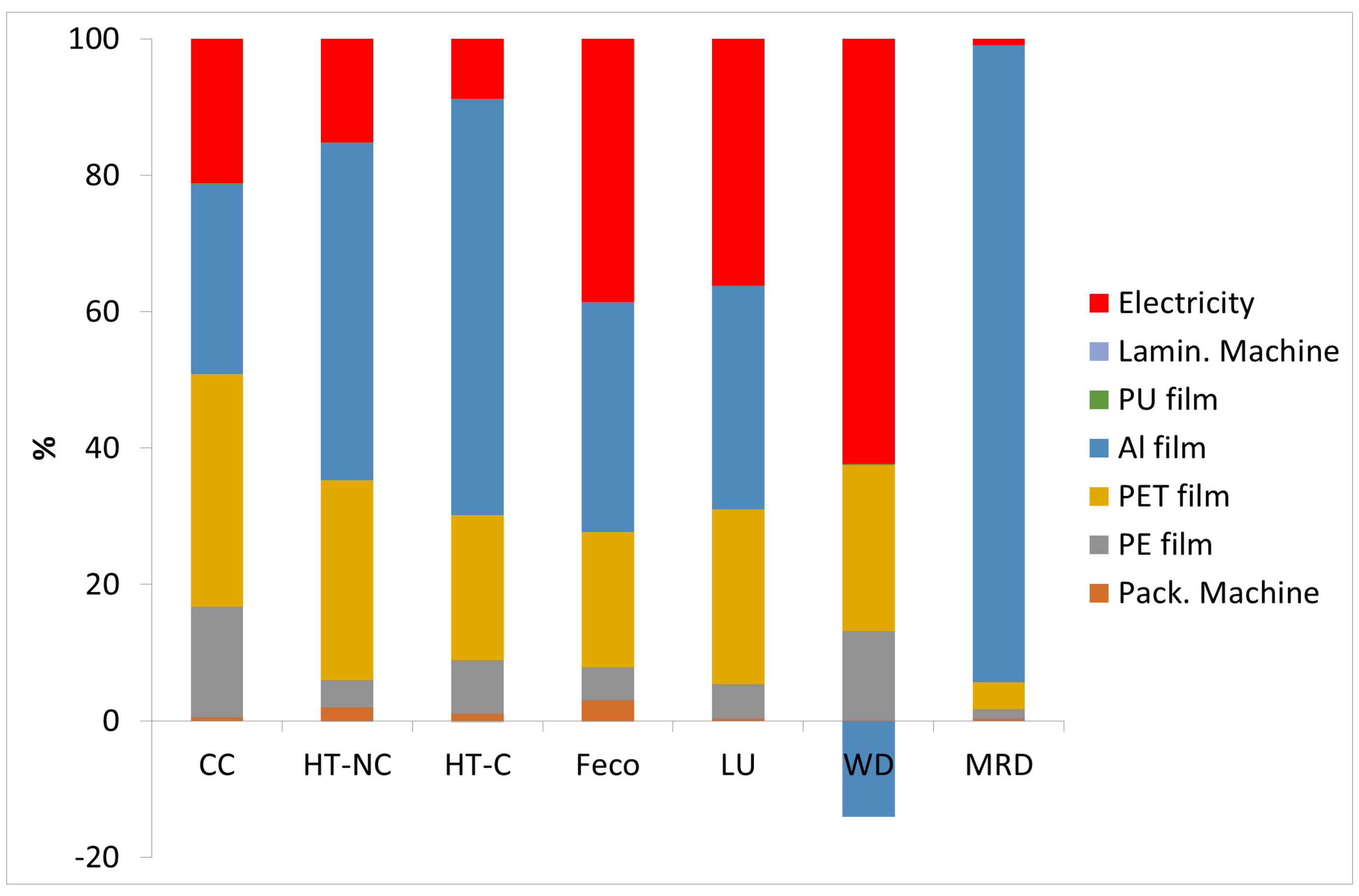


Figure 2: Percentage subdivision of the factors related to the production of the traditional packaging.

Figure 2 shows the environmental impact of the production of the traditional packaging. The main hotspot is the production of the aluminum film, ascribed mostly to the impact category Mineral Resource Depletion (MRD, 93%). This incidence is due to the extraction (also called mineral cultivation) of the bauxite. Another hotspot is the PET production chain; its incidence is related to all the impact categories, with particular high values for the climate change (CC, 34%). The electricity required by the transformation machines is the third hotspot from 8.8% Human Toxicity (HT-C) to 62% Water Resource Depletion (WD). The high demand of electricity is due to the machines dimension and the type of processing.

Figure 3 represents the impact assessment related to the production of the innovative packaging. The main hotspot of the innovative packaging is the PLA film production; the high level of incidence of this material is explained by the composition of the innovative packaging, the PLA film represents more than 70% of the total weight. The incidence and high level of impact in all the impact categories are due to the process activities to obtain the bio-based polymer. The PLA undergoes a fermentation phase that requires a high quantity of water, thus reaching the 85% of incidence in the impact category WD.

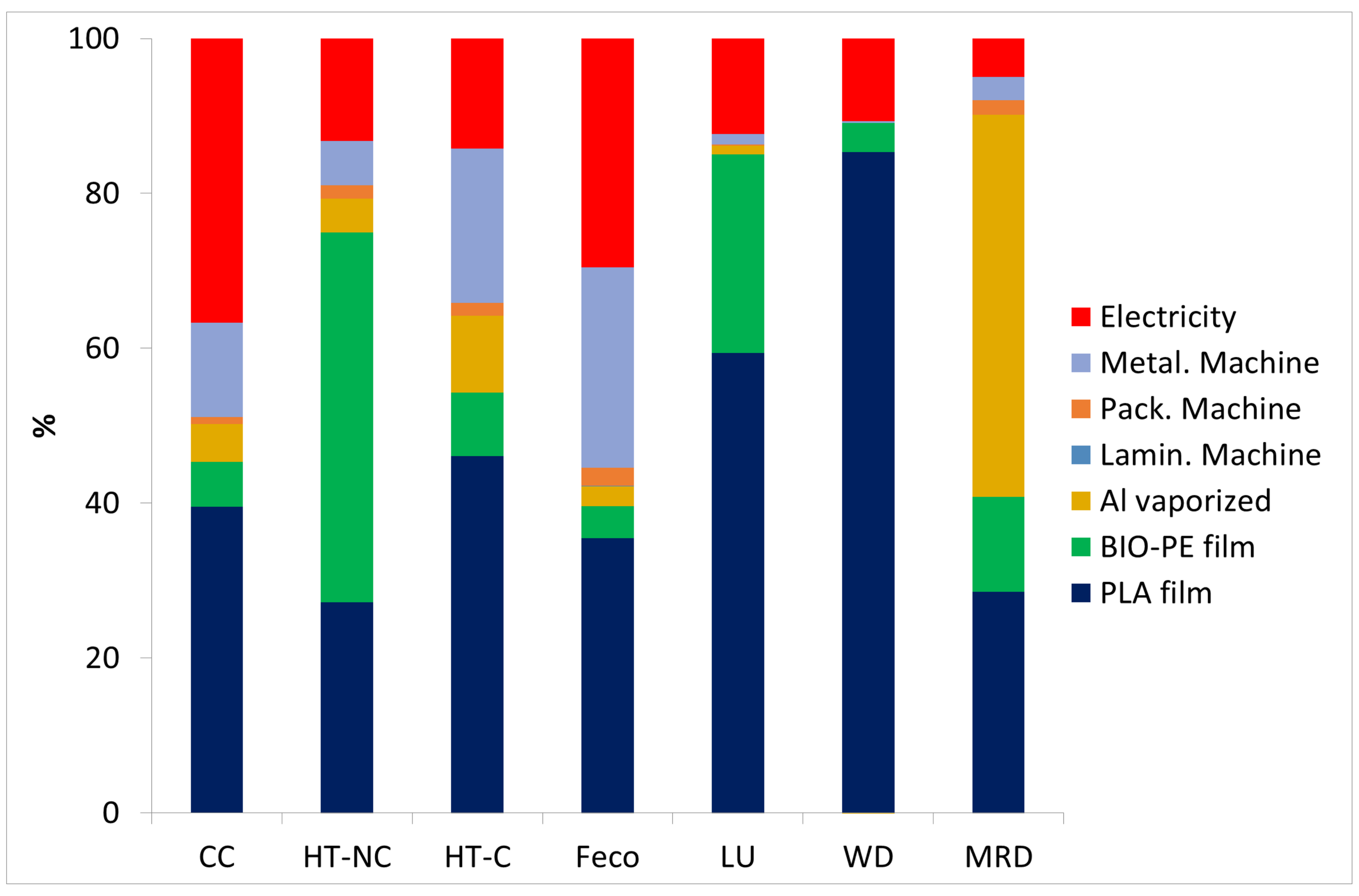


Figure 3: Percentage subdivision of the factors related to the production of the innovative packaging.

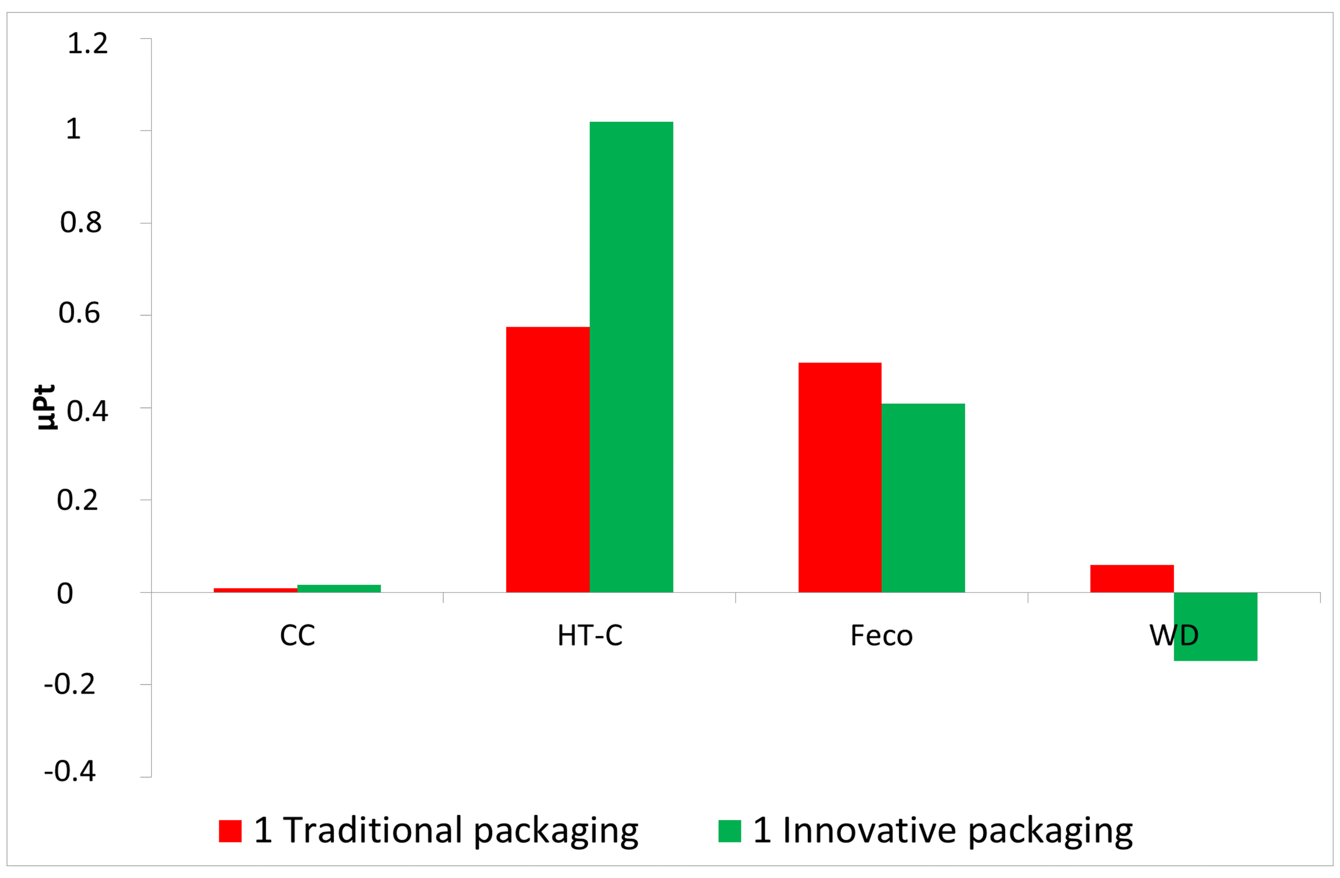


Figure 4: Comparison of the environmental profile of the two packaging materials for the most relevant impact categories

A comparison of the two products is fundamental to identify what packaging is better in each impact category. Figure 4 represents the weighted results of the LCA study. At the same time it can define the incidence and the gap between the two packaging relating to each impact category. Regarding the CC, the innovative packaging production release 44% less of kg CO_2 eq (0.96 g) respect to the traditional packaging (1.71 g). The same positive observation can be done for the impact category HT-C. The impact categories related to the ecosystem quality, as Feco (Freshwater Ecotoxicity) and WD, present higher values for the innovative packaging than for the traditional packaging.

Conclusion

A final comparison of the environmental profiles of the two single-dose plastic packaging helped to clarify that there is no overall better solution. The innovative packaging, even if it is made of bio-based raw materials, shows better profile only in some of the impact categories (CC and HT-C). As for the ecosystem quality, the innovative packaging has the worst environmental performance (+78% Feco and + 14.6% WD) due to the activities necessary along the production chain (cultivation of the maize, production of the starch; machines for farming activities; fermentation and chemical processes for polymers production).

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