

1 ottobre 2018
CLEVER EARTH CONCEPT
Resource regeneration for food sustainability

Progetto di ricerca sostenuto da Fondazione Cariplo:
Integrated research on industrial biotechnologies 2015
“BIOCONVERSION OF FRUIT AND VEGETABLE WASTE TO EARTHWORM MEAL AS NOVEL FOOD SOURCE”

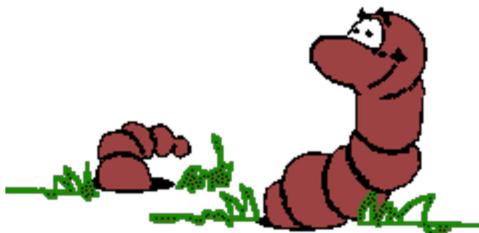
Scarti ortofrutticoli + lombrichi: sostenibili o no?

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Sustainable?

Environmental evaluation

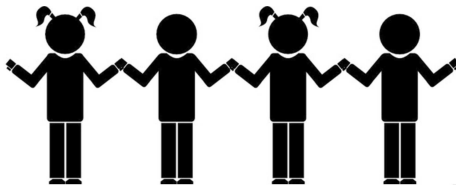
Fresh earthworms



Fruit and vegetable waste



Freeze-drying



Drying



- Earthworms provide an excellent ecosystem services, especially soil-working, scavenging, soil bioremediation, pollutants removal, improving nutrient availability in soil, which are all of enormous value.
- In our study, earthworms reared on fruit and vegetable waste to produce safety food were evaluated, as well as the environmental risk assessment (ERA) for aquatic and terrestrial environment, taking into account: Climate Change, Ozone Depletion, Particulate Matter Formation, Human Toxicity-No Cancer Effect, Human Toxicity-Cancer Effect, Photochemical Ozone Formation, Terrestrial Acidification, Terrestrial Eutrophication, Freshwater Eutrophication, Marine Eutrophication, Freshwater Ecotoxicity, Mineral and Fossil Resource Depletion

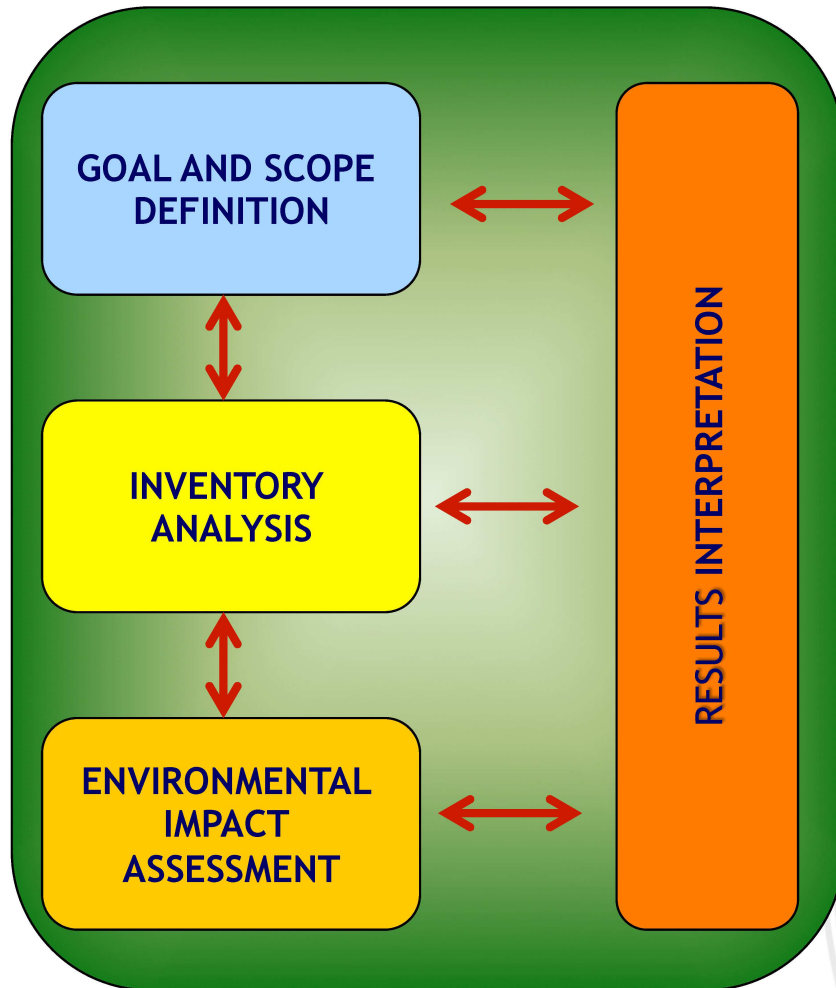


- LCA is the most widely accepted method to evaluate the environmental effects related to a production process. It considers the whole life cycle of the products from the extraction of raw materials to the management of the produced wastes
- LCA is defined by the ISO standard 14040:2006 and ISO 14044:2006 methodology



OUTPUT OF A LCA STUDY:
The environmental labels such as Carbon footprint & Water footprint are assessed by applying LCA

According to ISO 14040 and ISO 14044, LCA involves four distinct and interdependent phases:



1 - GOAL AND SCOPE DEFINITION

Definition of the aim of the study as well as of the **system boundary** and **functional unit**

2 - INVENTORY ANALYSIS

Collection of data regarding **inputs** and **outputs** of both the system and the environment and of the different steps of the system

3 - ENVIRONMENTAL IMPACT ASSESSMENT

Conversion of the inventory data in few numeric indexes of environmental impact (thanks to specific characterisation factors)

4 - RESULTS INTERPRETATION

Identification of the environmental hotspots and comparison

AIM → assess the environmental impact of the bioconversion of fruit and vegetable waste into earthworms dried meal

- as new food source
- *as new feed source (future)*



The environmental impact of earthworm dried meal was evaluated adopting the Life Cycle Assessment (LCA) method with an attributional approach and economic allocation.

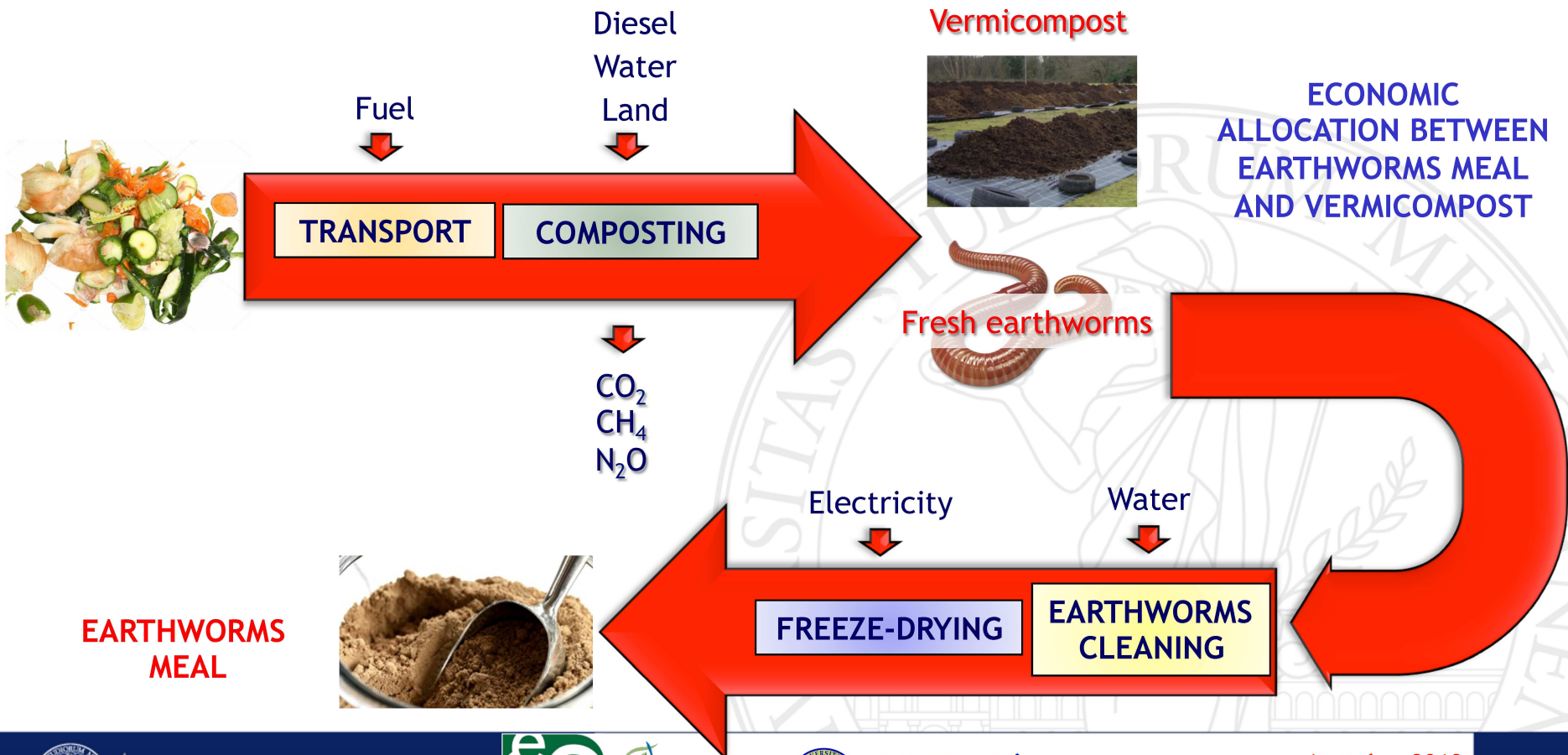


Identification of the functional unit and definition of the system boundary

FUNCTIONAL UNIT = 1 kg of earthworms meal (67% proteins)

SYSTEM BOUNDARY: «from farm to gate».

All processes from the recovery of fruit and vegetable waste to earthworm freeze-drying and drying to produce meal for food or feed consumption. The subsequent "processing" of meal to produce any food preparations is excluded.



Inventory data concerning inputs and outputs relevant to the production of earthworms' biomass were collected during the rearing period.

- **Primary data** were collected with questionnaires during interviews with the farmer.
 - These regarded mainly the amount of FVW used as feed, fossil energy for preparing the feed substrate, tap water, land occupation for earthworms breeding, etc.
- **Secondary data** about tap water for washing earthworms, electricity for processing earthworms into dried meal and fossil fuel for transport activities were obtained from Ecoinvent databases.



COMING TO THE RESULTS: FRESH EARTHWORMS

- Transport of fruit and vegetable waste from the food industry to the composting plant represents the largest contributor to the environmental impact.
- The emissions that occur during fruit and vegetable waste composting are the main contributors (93%) to Climate Change.

RESULTS: FOOD (MEAL)

- The consumption of electricity is the main responsible of the environmental impact of the dried meal.



- The results showed that earthworms environmental impacts is mainly due to the energy used during transport and the processing of fresh earthworms into dried meal.
- Enhancing earthworm productivity and reducing the energy consumptions of the processing process is necessary to make earthworm dried meal a sustainable source of food/feed for human and animal nutrition.



GRAZIE PER L'ATTENZIONE

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