Agri & food waste valorisation co-ops based on flexible multi-feedstocks biorefinery processing technologies for new high added value applications

Integration of the composting process in a biorefinery

María J López
Universidad de Almería

Webinar training session on agricultural by-products valorisation through bio-refineries - April 15th, 2021
Organizer: FCAC

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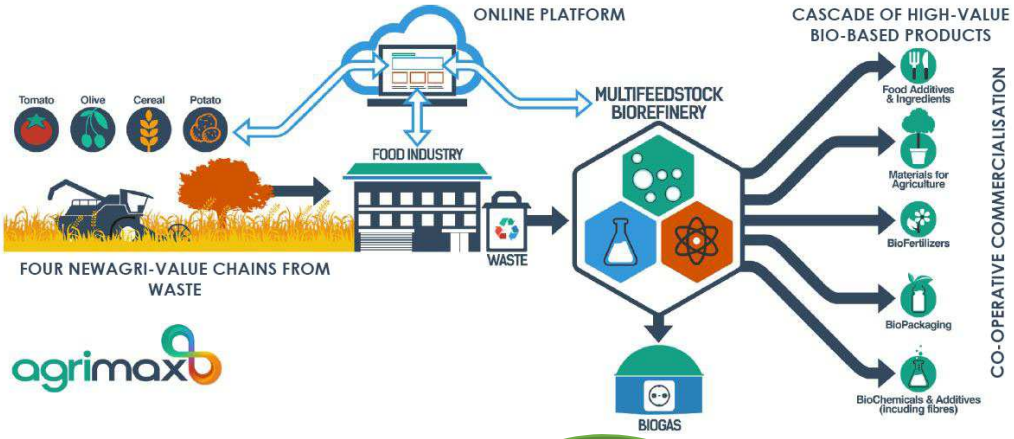
Bio-based Industries Consortium

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No. **720719**.

Outline

- Composting
- Compost and related products
- Composting in biorefinery
- Integration models in Agrimax



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Composting

- **Controlled aerobic decomposition of biodegradable materials** by **microorganisms**
- Allows the **development of temperatures** suitable for thermophilic bacteria as a result of **biologically produced heat** (**self-heating**).
- All parts of each batch shall be either **moved and turned or subject to forced ventilation** in order to ensure the **correct sanitation and homogeneity** of the material.

- Produces **compost**: a stable humic-rich organic substrate that **improve soil properties** and **promote plant growth**

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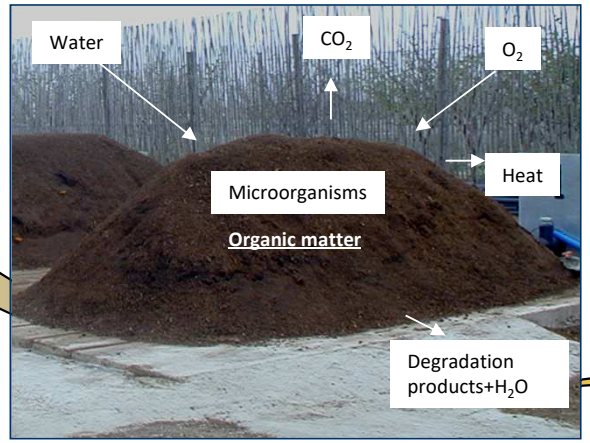
Composting

Organic waste

- Particle size (2-5 cm)
- C/N ratio (25-30)
- Moisture (40-50%)
- Mixture/homogenization
- (Pile up)



Input materials → **Composting** → **Post-processing** → **Compost**

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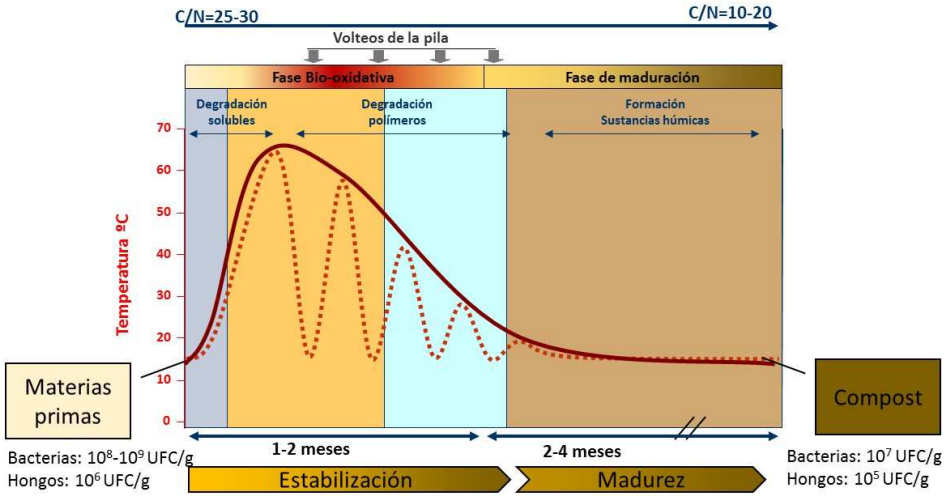
Composting

Organic waste



Input materials → **Composting** → **Post-processing** → **Compost**

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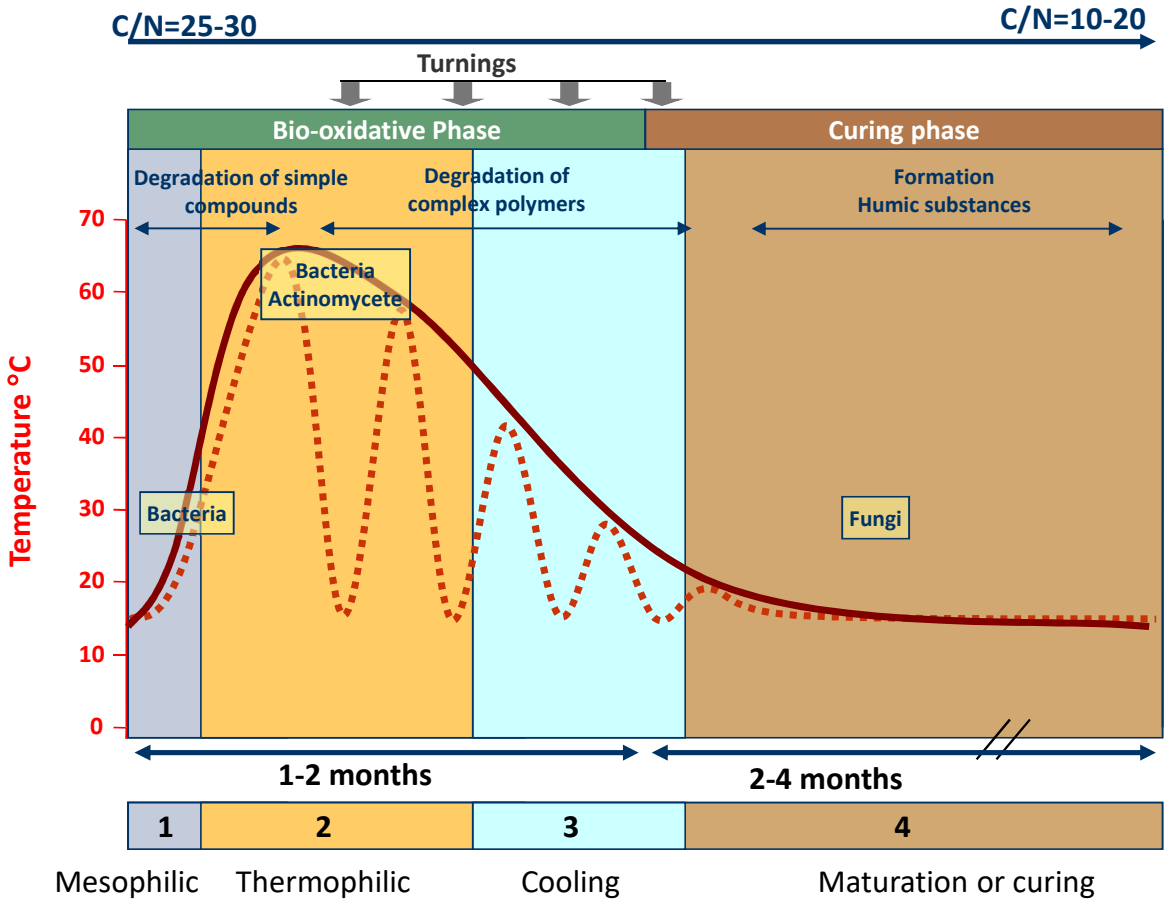
Composting



Bio-oxidative phase

- Fast biodegradation
- Intense microbial activity (heat produced)
- Thermal variations (measurement)
- Turning / forced aeration
- Posible control

correct sanitation Temperature-time profiles (REGULATION (EU) 2019/1009)

- ≥70 °C for at least 3 days
- ≥ 65 °C for at least 5 days
- ≥ 60 °C for at least 7 days
- ≥ 55 °C for at least 14 days

Curing phase

- Slow Biotransformation
- Sporadic turning advisable

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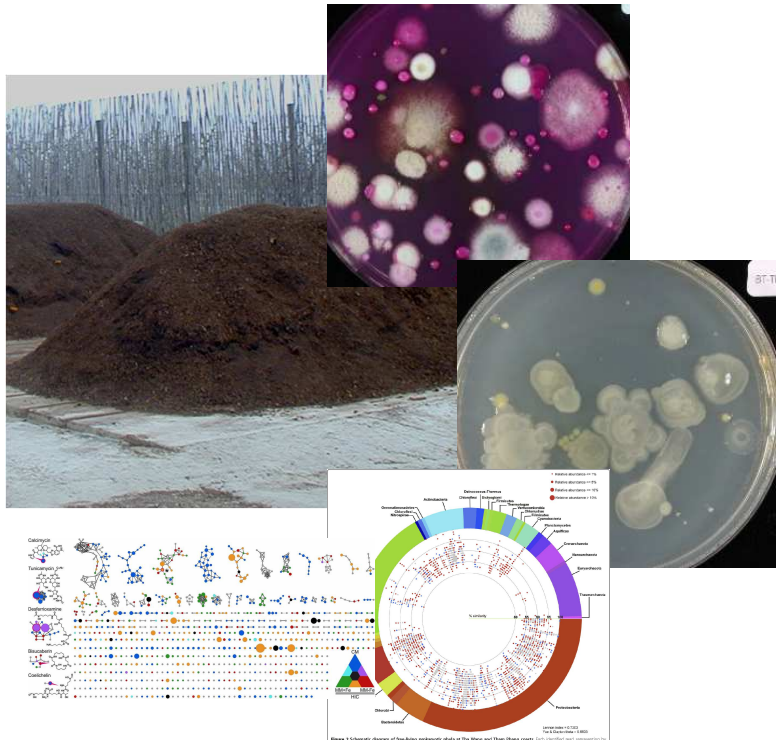
Compost and related products

Compost properties

The living part - microorganisms

Bacteria: *Rhodothermus, Thermobispora, Symbiobacterium, Sphaerobacter, Thermobifida, Clostridium, Geobacillus, Bacillus, Ureibacillus, Streptomyces….*

Fungi: *Fusarium, Haematonectria, Galactomyces, Doratomyces, Geomyces, Thermomyces, Acremonium, Ascobolus, Mortierella, Aspergillus, Penicillium, Mucor, Alternaria …….*



High biodiversity	> 10,000 OTUs Bacteria
Taxon & Functional	> 4,000 OTUs Fungi

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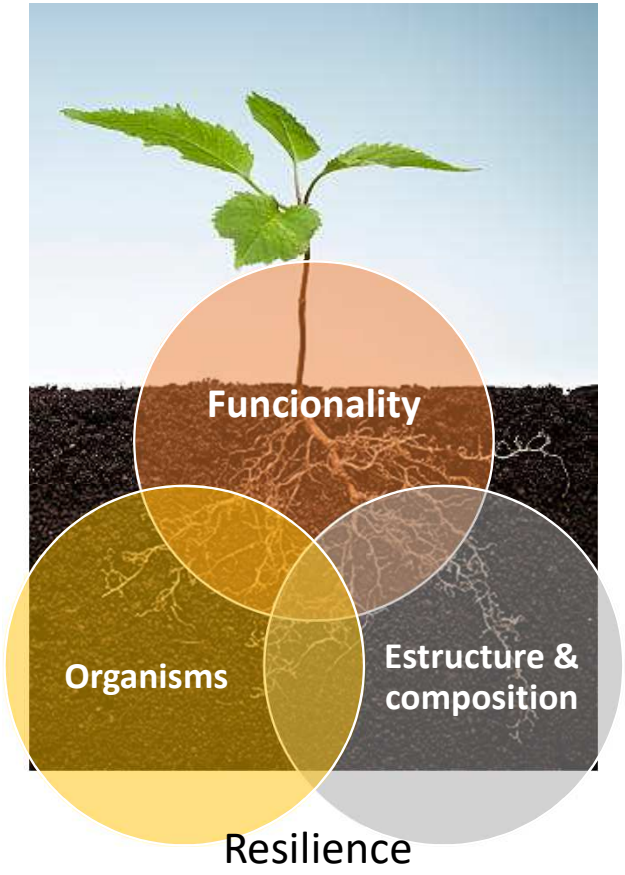
Compost and related products

Compost properties



Quality Compost

Beneficial effect for the soil and the plant

Agronomic functionality

- Stable: Respirometric index <25 mmol O_2/kg m.o./h
- Mature: Phytostimulant GI>90-100%
- Physical properties

Increase/improve
- Germination
- Root growth
- Nutrients absortion
- Soil structure

Reduction
- Plant disease

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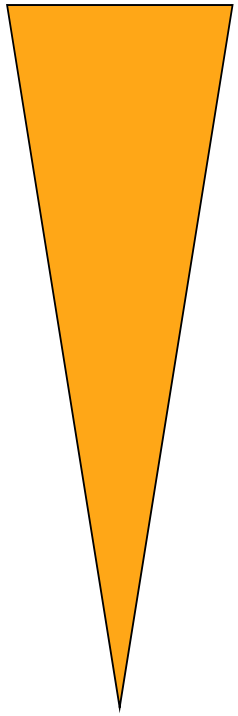
Compost and related products

Compost applications

Quality requirements



Substrate in containers (nursering/ transplanting)

Substrate for agriculture and horticulture

Soil erosion control and restoration (other uses: biofilters, bioremediation)

Pascual et al. (2018). *Agron. Sust. Develop. 38*, 1.

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Compost and related products

Products from compost

- Alkaline extract: **Hydrocompost** (rich in humic substances)

- Aqueous extract: **Compost tea** (rich in microorganisms)

Fertigation
Foliar application

- **Functional compost** (bioactive, fortified, improved or “a la carte”)

Suplementation with microorganismos:
Biofertilizer: provide more nutrients to plants
Supressive compost: Plant disease control specific for pathosystems.

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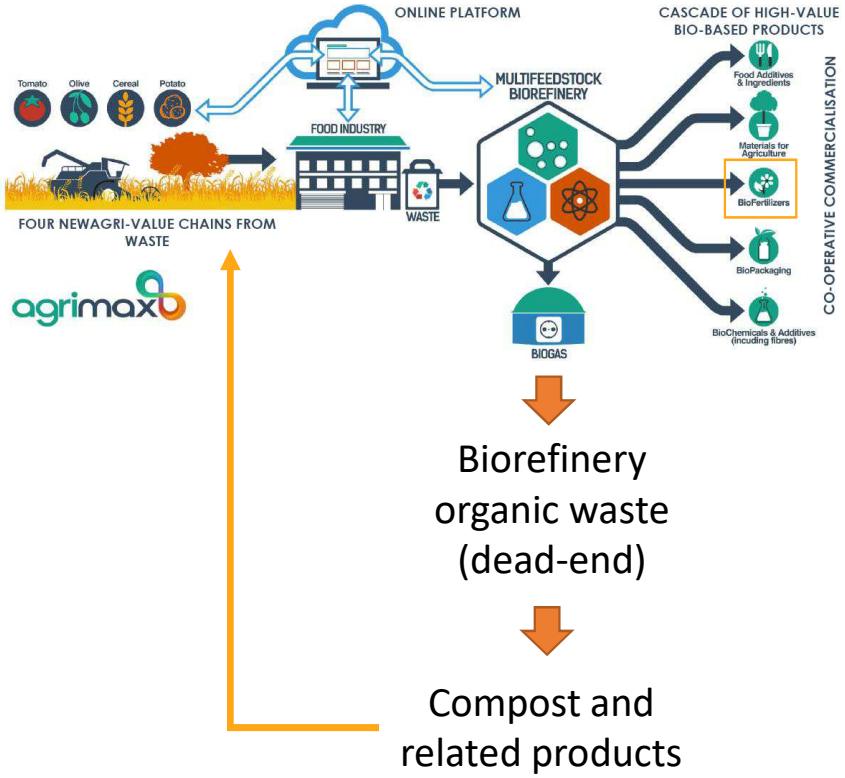
Composting in biorefinery

- **Organic residues from extraction/production** in the biorefinery can be processed by composting (properly mixing)
- Composting is advisable prior agricultural aplication also for the **sludge obtained after anaerobic dig**estion for energy (biogas) recovery
- Allows to **recover all biorefinery organic leftovers** and close the loop by returning stabilized (and safe) organic matter to the soil
- **Diversified compost-related products** can be obtained, more products for the biorefinery



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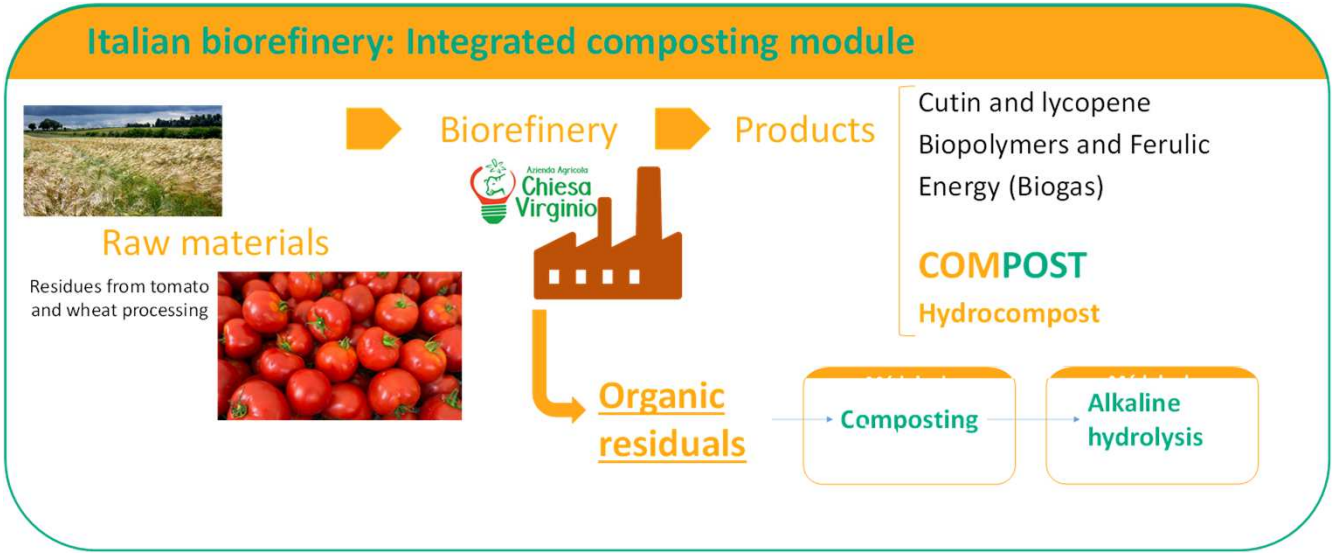
Integration models in Agrimax



Tomato (cull fruit & plant) waste

Composting

COMPOST

Alkaline hydrolysis

Hydrocompost

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Integration models in Agrimax

Spanish biorefinery: Composting module not integrated

Raw materials

Residues from olive oil, potato and oatmeal

Biorefinery

Indulleida

Products

- Aroma
- Polyphenols
- Proteins
- Fibre
- Culture media components

Organic residuals → COMPOST

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Thanks for your attention!

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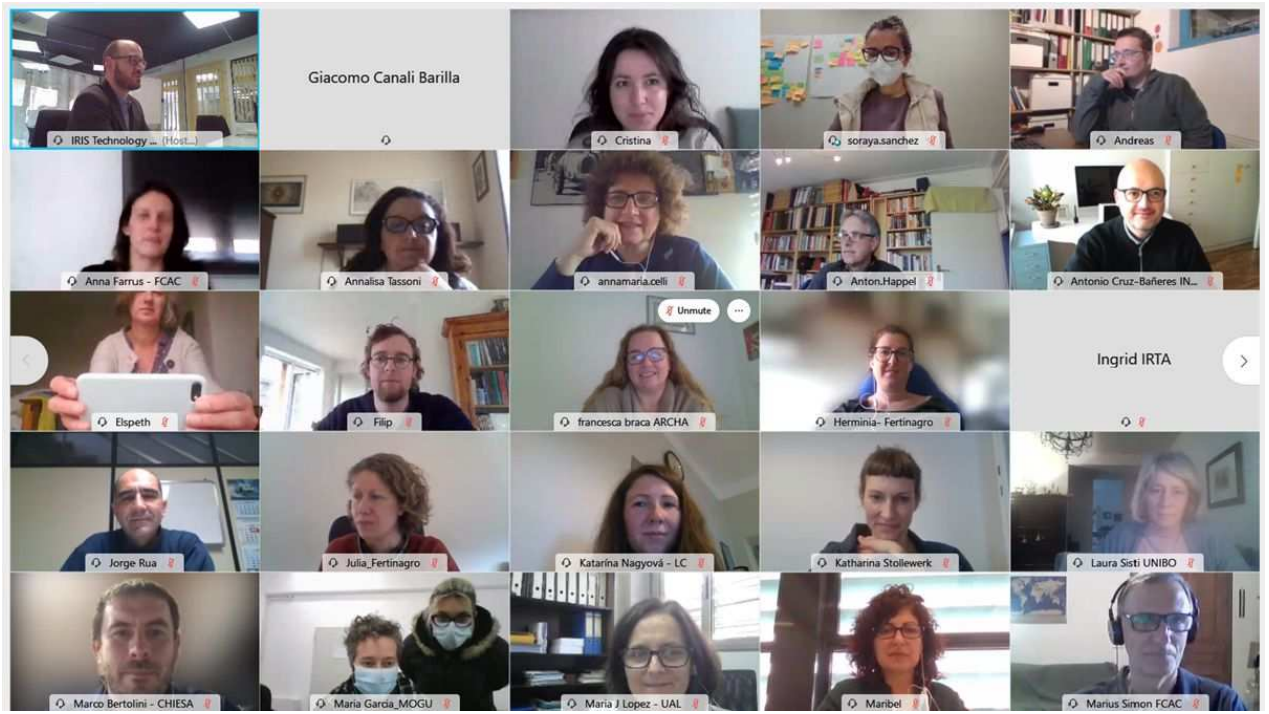

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