



INTEGRATED PROTECTION IN VITICULTURE

Vila Real, 5 - 8 November 2019



Bio-potential of composted agro-food-wastes as natural fungicides against *Botrytis* and *Fusarium* wilt diseases

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Monoculture

indiscriminate
use of pesticides

intensive culture

Inadequate
cultural
practices





Composting

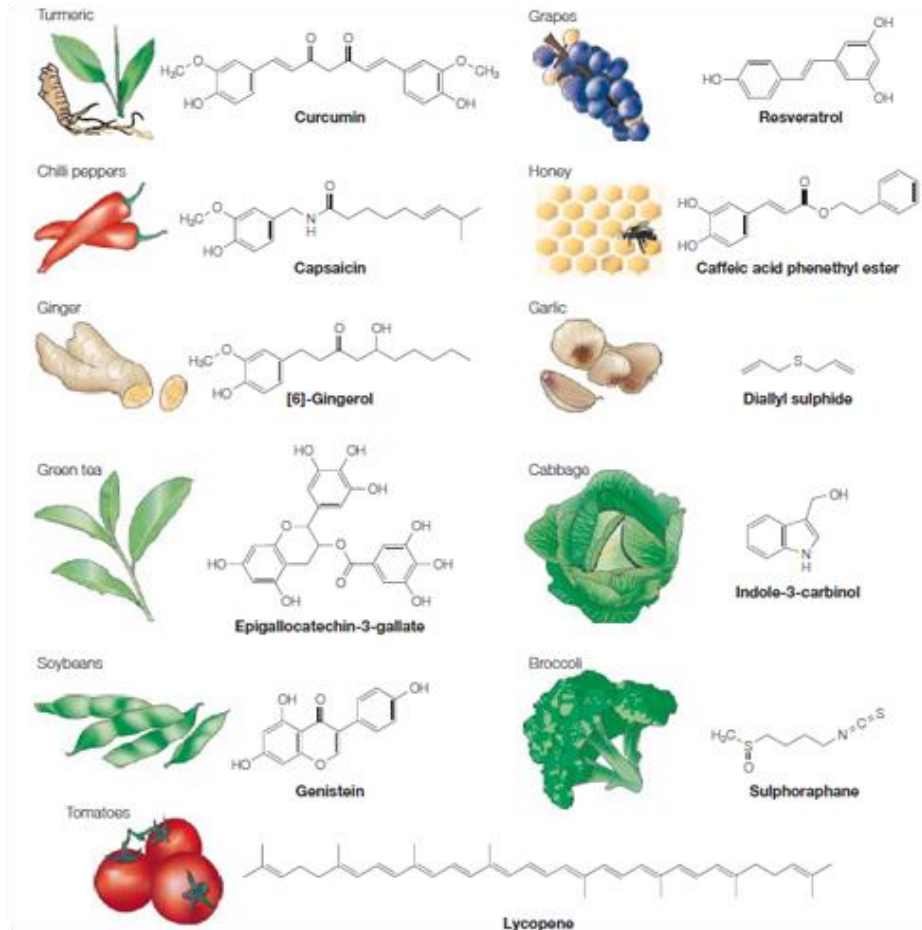
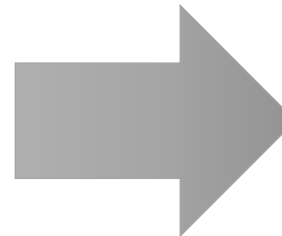
- Degradation and stabilization of organic matter
- Destruction of pathogenic microorganisms and weed seeds
- Sanitation
- Volume reduction of organic matter
- Reduction of environmental pollution



Composts

- Natural fertilizer
- Appropriate density and porosity
- Water holding capacity
- Stabilizer (immobilizes soil heavy metals) - Bioremediation
- Biological activity

Phytochemicals



- Antifungals
- Antibacterials
- Nematicides
- Insect repellents
- Shellfish repellents

Task 1

- **Composting**
  - 1st assay: with coffee grounds
  - 2nd assay: with agro-industry wastes (Broccoli, Chestnut, Olive leaves, Grape marcs)

Task 2

- **Composts incubation in soil**

Task 3

- **Compost biosuppressive effect**
  - *in vitro* antifungal assay in soil phytopathogenic fungi (Macrodilution broth method)
  - *in vivo* suppression assay in soil phytopathogenic fungi (Pot experiments)

Task 1

- **Composting**
  - 1st assay: with coffee grounds
  - 2nd assay: with agro-industry wastes (Broccoli, Chestnut, Olive leaves, Grape marcs)

- Study the composting process of **phytochemical rich materials** to **evaluate if their composition affects the composting process**
- **Determination** and **quantification** of phytochemicals
- Measure and assess the **impact of gaseous emissions** from each waste used
- **Production of bioactive composts**

Task 2

- **Composts incubation in soil**

- Determine the **effects** of amending **composts** on the **mineralization of organic C and N** added to the soil
- Determine the **effects of amending composts** on the **emissions of the C and N gaseous compounds** with environmental significance

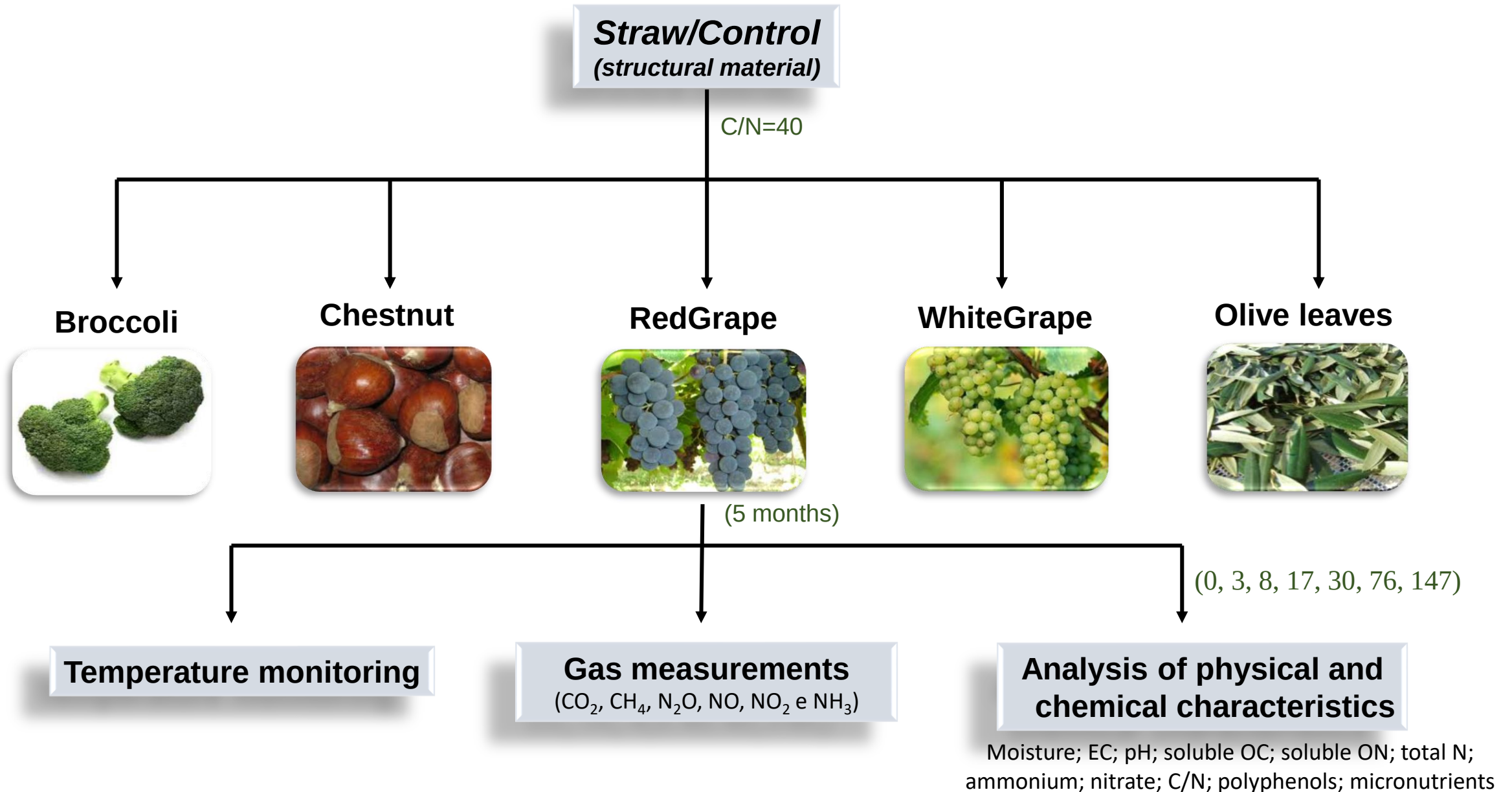
- Determine the **disease suppressiveness potential** of four selected composts against *Botrytis cinerea* and *Fusarium oxysporum*
- Evaluate the **effects** of four selected composts on **lettuce yield**

Task 3

- **Compost biosuppressive effect**
  - *in vitro* antifungal assay in soil phytopathogenic fungi (Macrodilution broth method)
  - *in vivo* suppression assay in soil phytopathogenic fungi (Pot experiments)

Task 1: composting experiments







Straw + Mimosa
(structural material)

Control

C/N = 20

Spent coffee
grounds
10%

Spent coffee
grounds
20%

Spent coffee
grounds
40%



(≈ 5 months)

Temperature monitoring

Gas measurements
(CO₂, CH₄, N₂O)

**Analysis of physical and
chemical characteristics**

(0, 3, 9, 22, 41, 64, 105, 156)

Moisture; EC; pH; soluble OC; soluble ON; total N;
ammonium; nitrate; C/N; polyphenols; micronutrients



Soil / Control

60 t DW/ha
60% Field capacity

Straw



Broccoli



Chestnut



RedGrape



WhiteGrape



Olive leaves



Mimosa



Coffee



(55 days)

Gas measurements

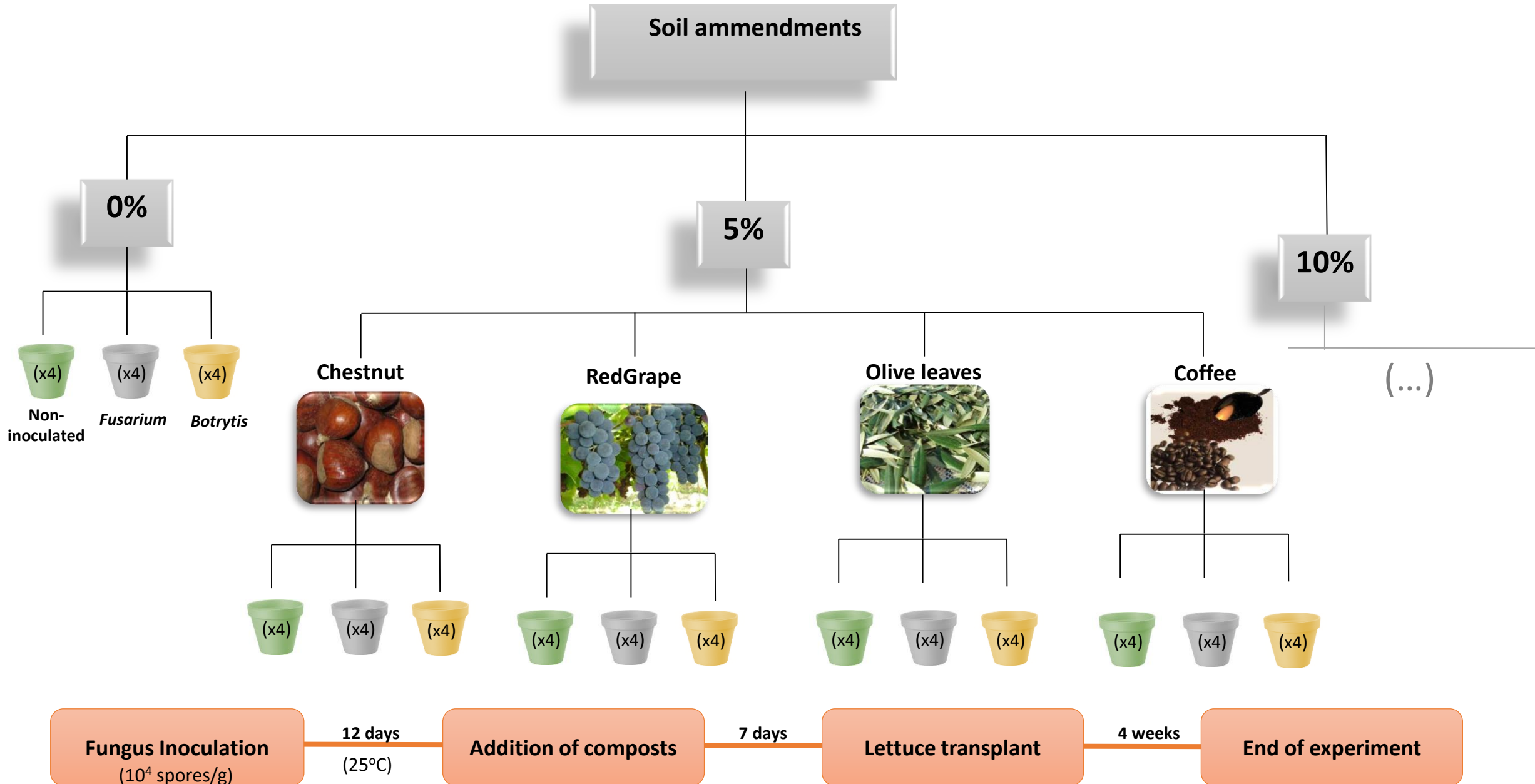
(CO₂, CH₄, N₂O)

Analysis of physical and chemical characteristics

soluble OC; soluble ON; total N;
ammonium; nitrate

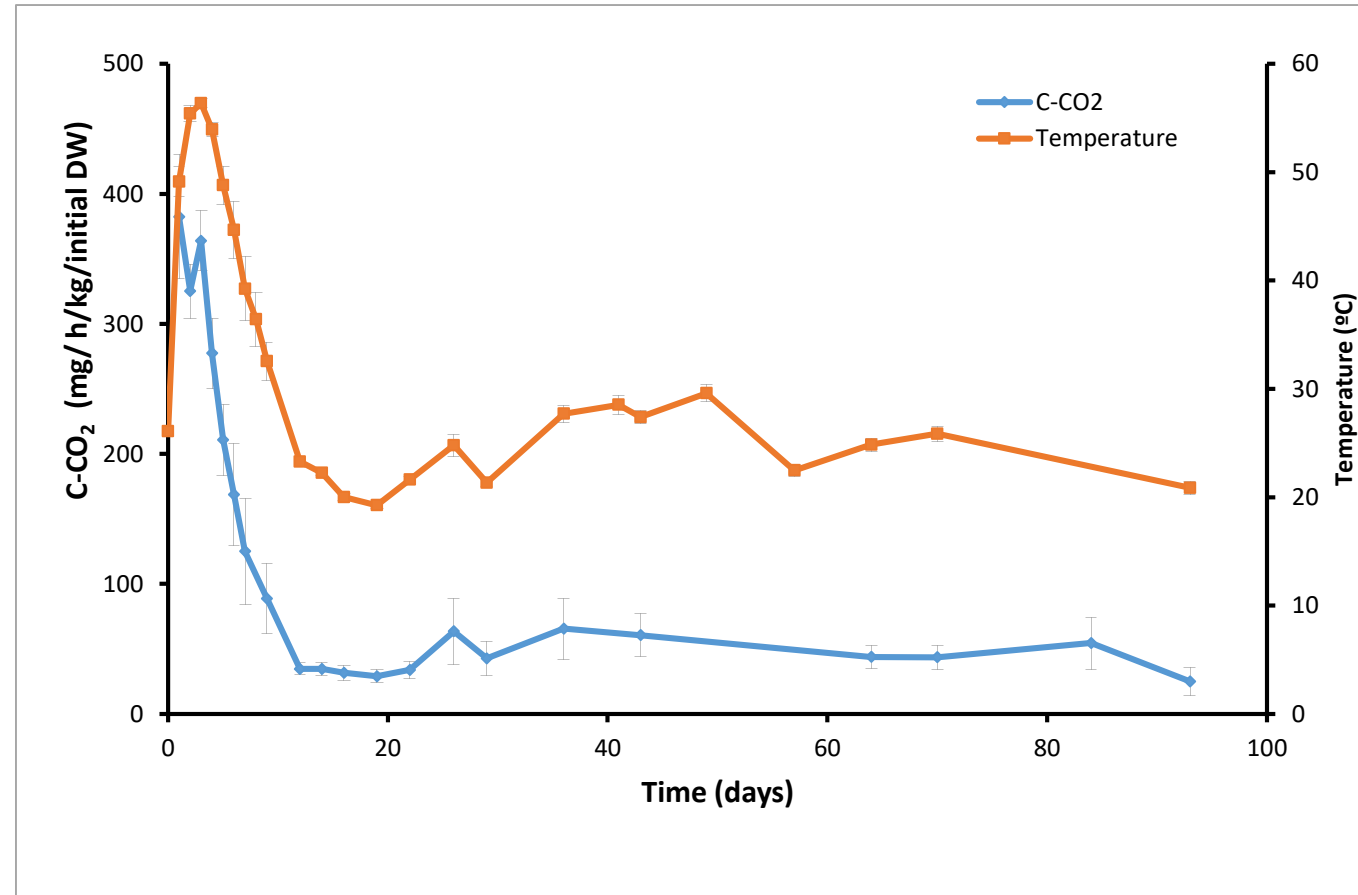
Task 3 – Suppressive effect





Process evolution:

- **Final pH close to 7**, indicating a mature compost (Lasaridi and Stentiford, 1998)
- **Increase of total nitrogen (Nt)** throughout the composting process
- **Micronutrient increase** over composting process

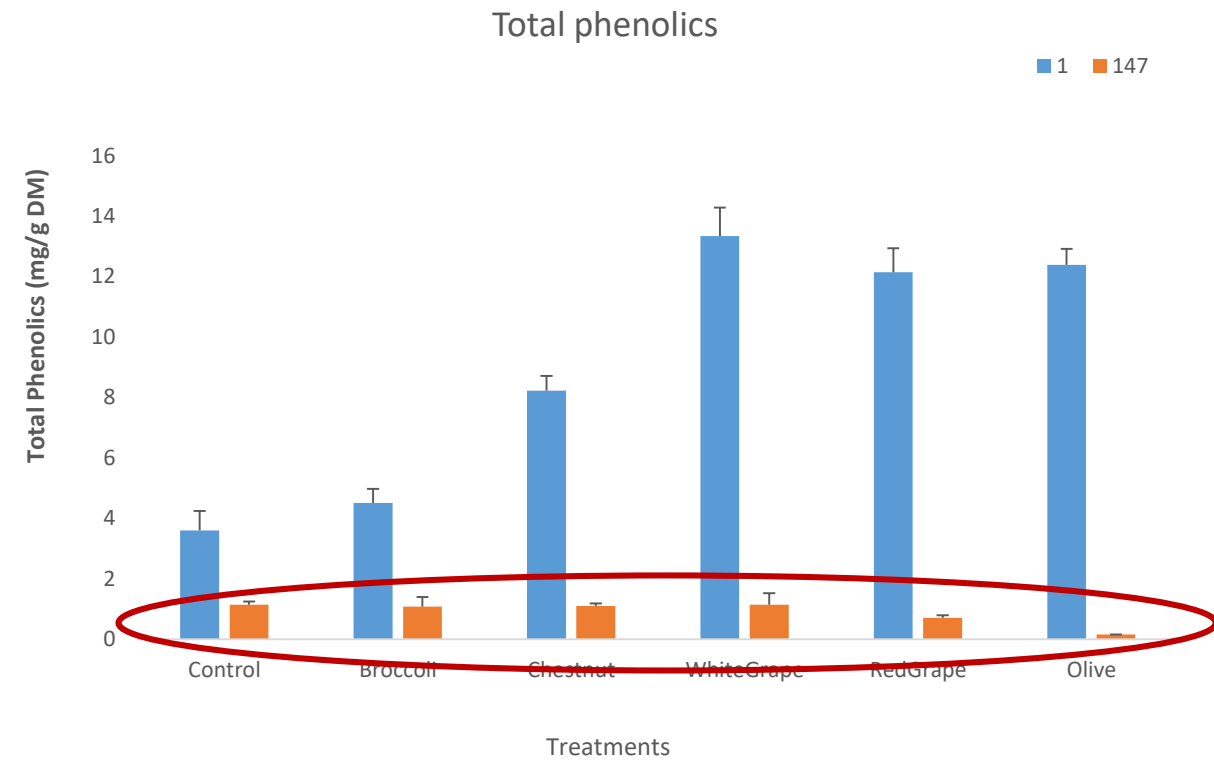


Greenhouse gas emissions:

Treatments	Emissions (g CO ₂ eq. kg ⁻¹)	Contribution (%)		
		CO ₂	CH ₄	N ₂ O
Straw	5,88	76,43	0,04	23,53
Broccoli	3,74	72,51	0,13	27,36
Chestnut	4,25	56,93	0,08	42,98
WhiteGrape	3,57	63,84	0,20	35,96
RedGrape	3,45	61,19	0,30	38,52
Olive leaves	3,03	62,83	0,27	36,90
Mimosa	1,76	67,91	0,76	31,32
Coffee	2,79	26,21	0,68	73,11

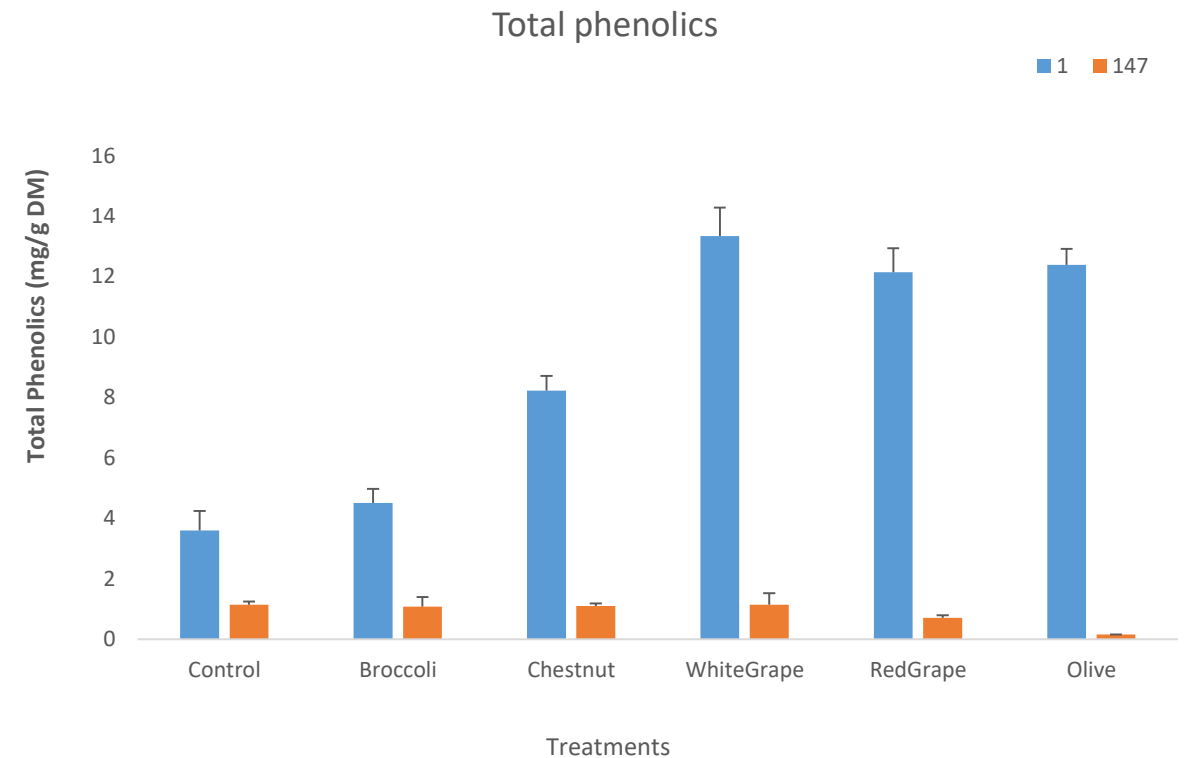
Cumulative greenhouse gas emissions (CO₂, N₂O and CH₄) expressed as CO₂ equivalents and the relative contribution of each gas.

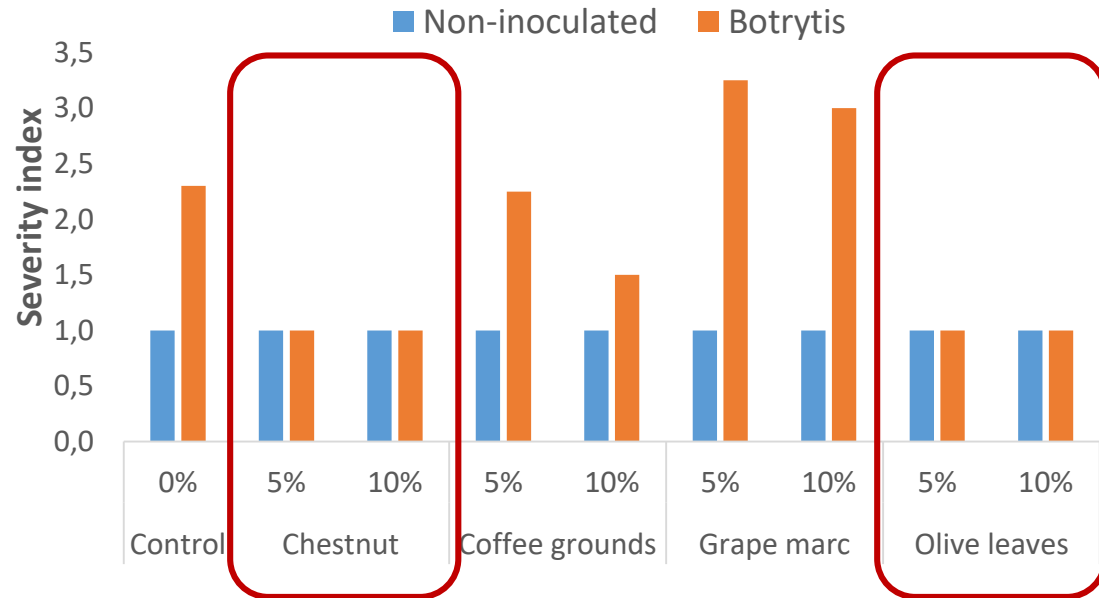
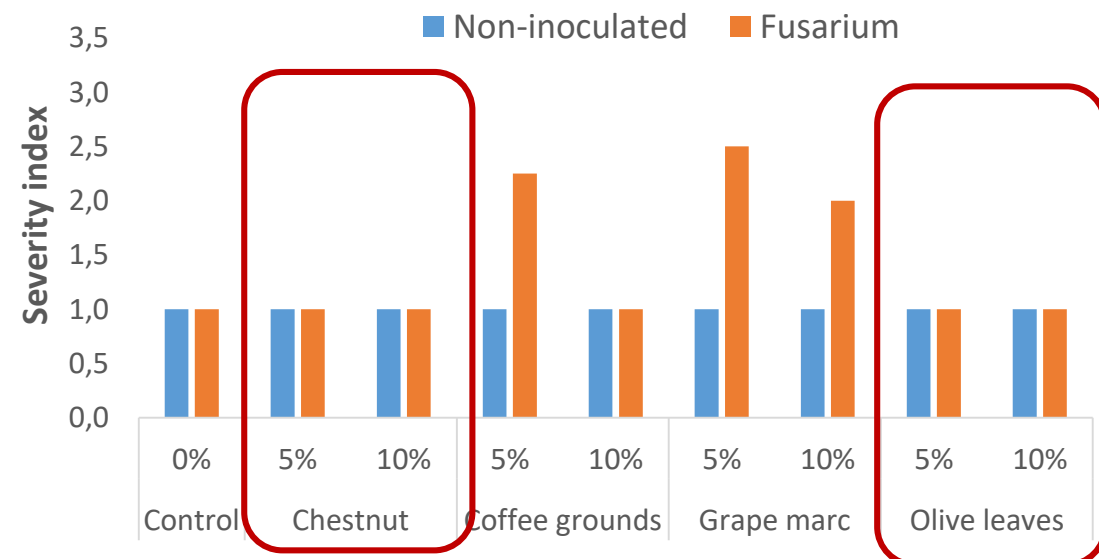
Phytochemicals



Phytochemicals

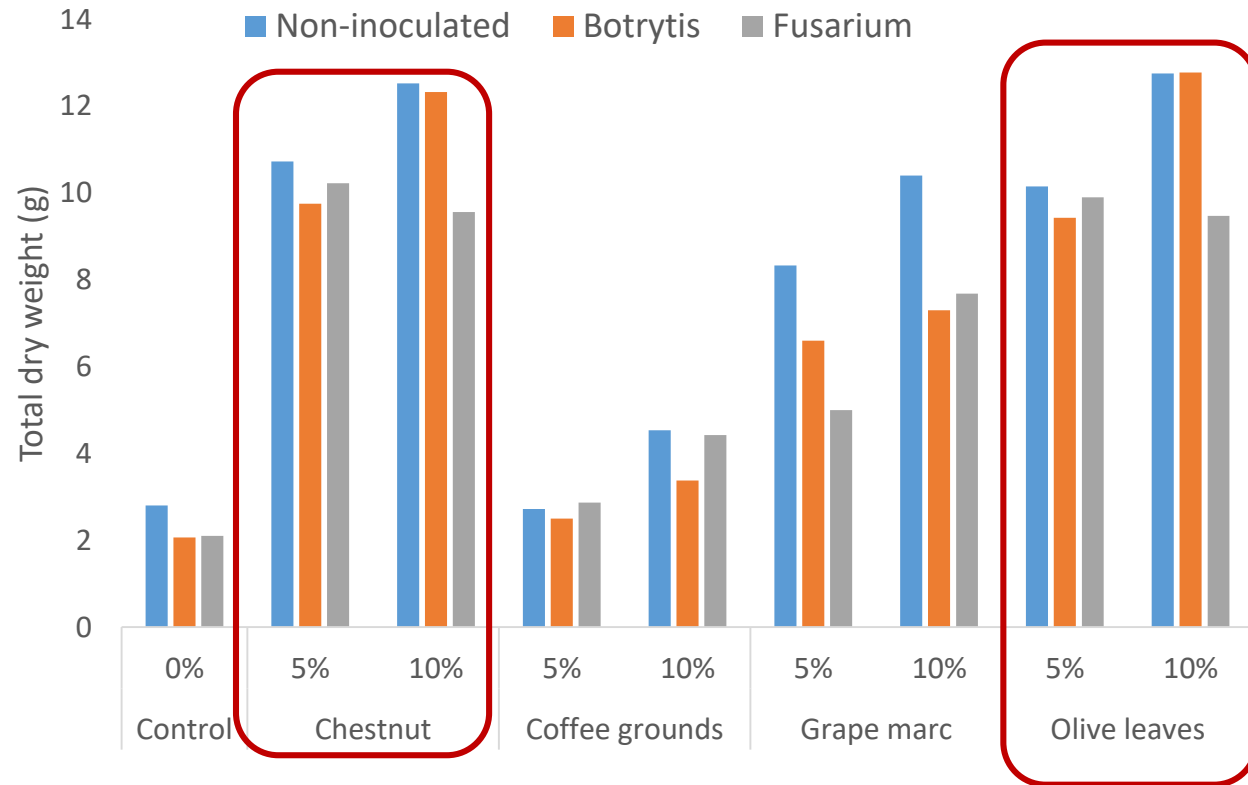
Treatments	Total phenolics (mg g ⁻¹ DM)
Day 1	
Control	44.43 ± 1.66 ^a
Coffee (40 %)	32.57 ± 1.02 ^c
Day 147	
Control	1.18 ± 0.03 ^a
Coffee (40 %)	0.89 ± 0.04 ^a





Severity index

- Lettuces grown with **Chestnut** and **Olive** compost had **no symptoms** for the two inoculated fungi
- Both applied doses (5 % e 10 %) showed suppressive effects
- **Coffee** and **RedGrape** revealed to be less effective to both fungi infections comparing to **Chestnut** and **Olive leaves** composts



Total weight

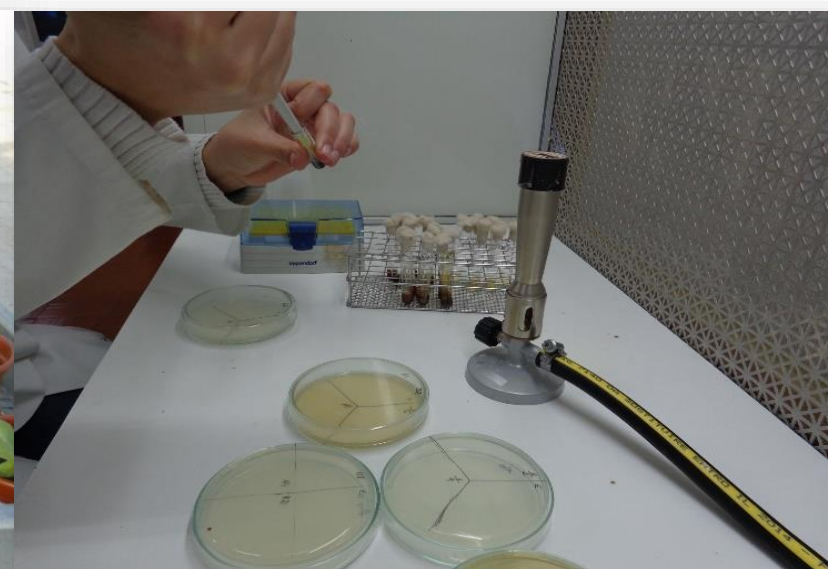
- **All treatments** promoted a **plant dry weight increase**, including Coffee and RedGrape composts.
- **Chestnut** and **Olive leaves** registered **greater dry weight**.
- **10% dose** showed greater total dry weight values.

- During composting process **total phenolic compounds decreased** (decreasing the potential phytotoxicity effect for the soil)
- Lettuces grown with **Chestnut** and **Olive** compost had **no symptoms** for the two inoculated fungi
- **Chestnut** and **Olive leaves**, in 10% dose, showed to be more effective to inhibit ***Botrytis cinerea*** and ***Fusarium oxysporum*** growth, promoting an increase on lettuce development
- The results revealed by this study **suggest a potential bio-pesticide effect of Olive leaves and Chestnut composts.**





Thanks for your attention!!!



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