

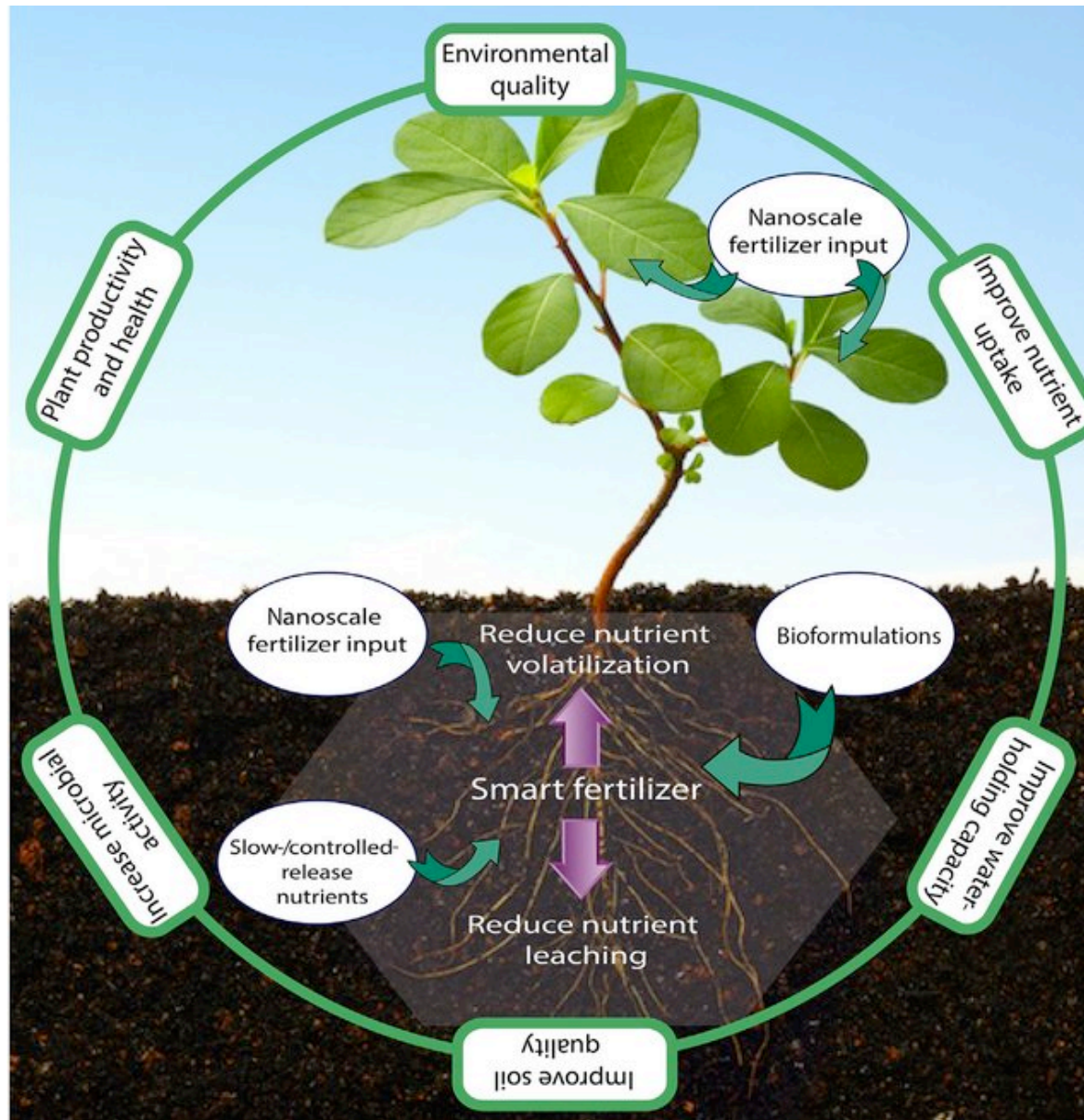


**INRAE**



**Ecotechnological approaches to reduce CO<sub>2</sub> emissions during composting and after soil application**

# Smart fertilizers as a strategy for sustainable agriculture



We need to use modern (sustainable technologies to find solutions to improve agricultural production

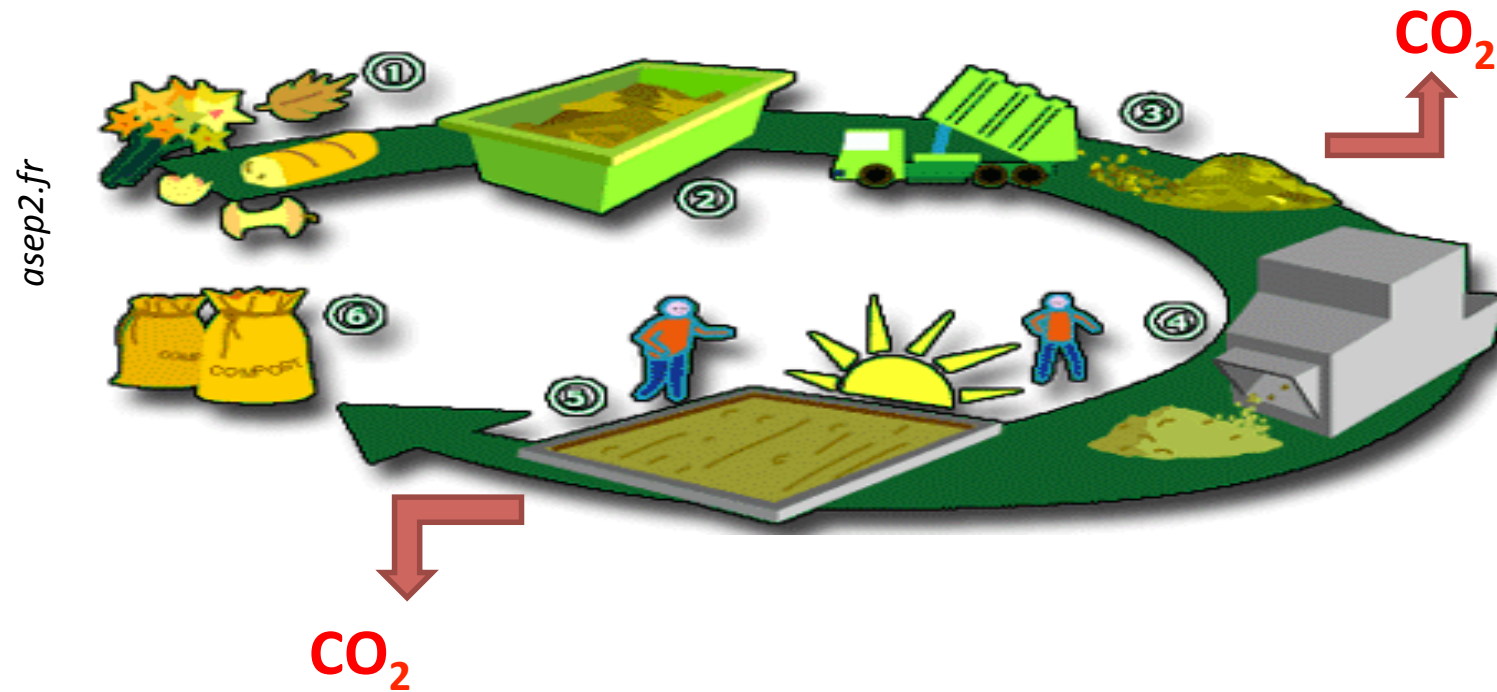
Recycling of organic « waste » materials:

- Carrier material for smart fertilisers
- organic amendments

➔ **Composting**

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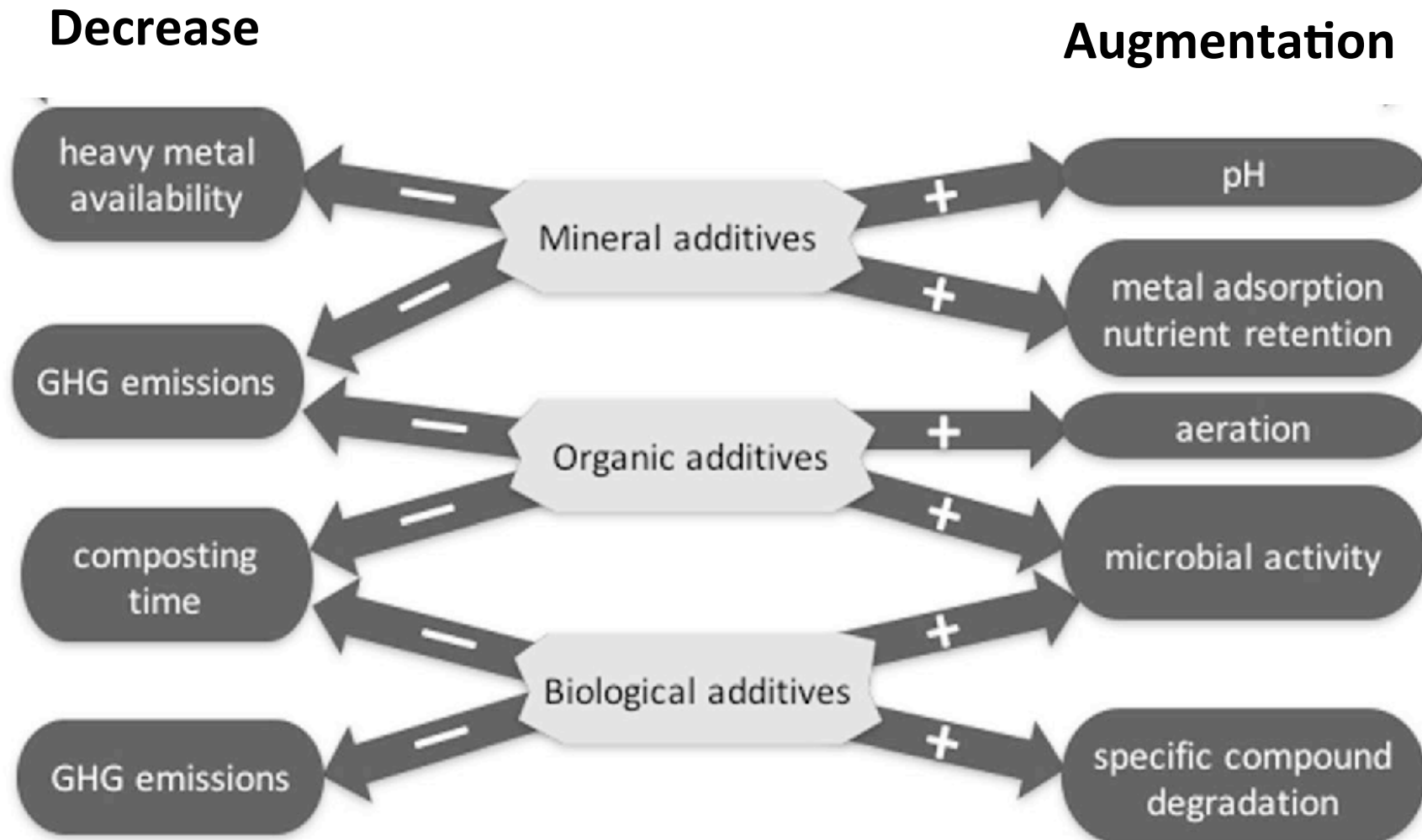
... but composting leads to CO<sub>2</sub> emissions before and after field exposure



How to reduce these emissions ?

# Composting with additives

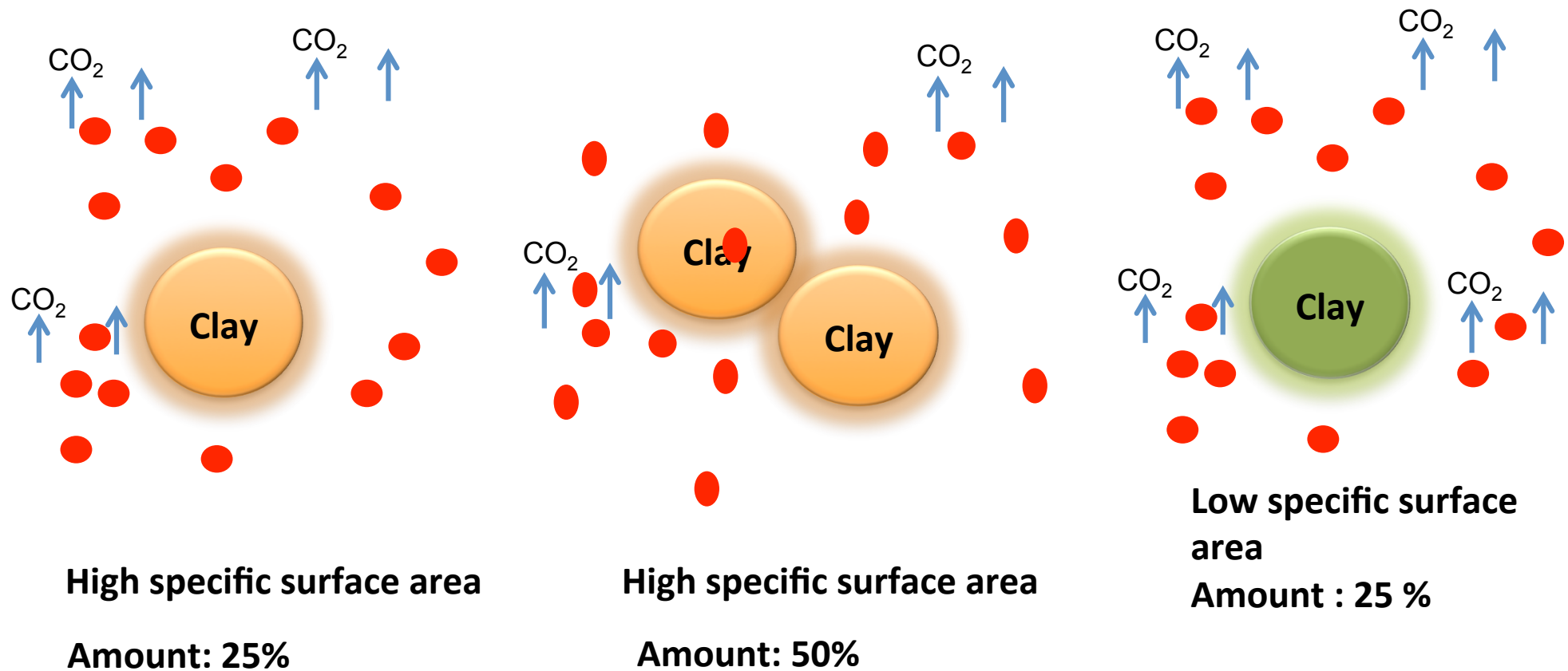
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# Development of organic 'low emission fertilizers

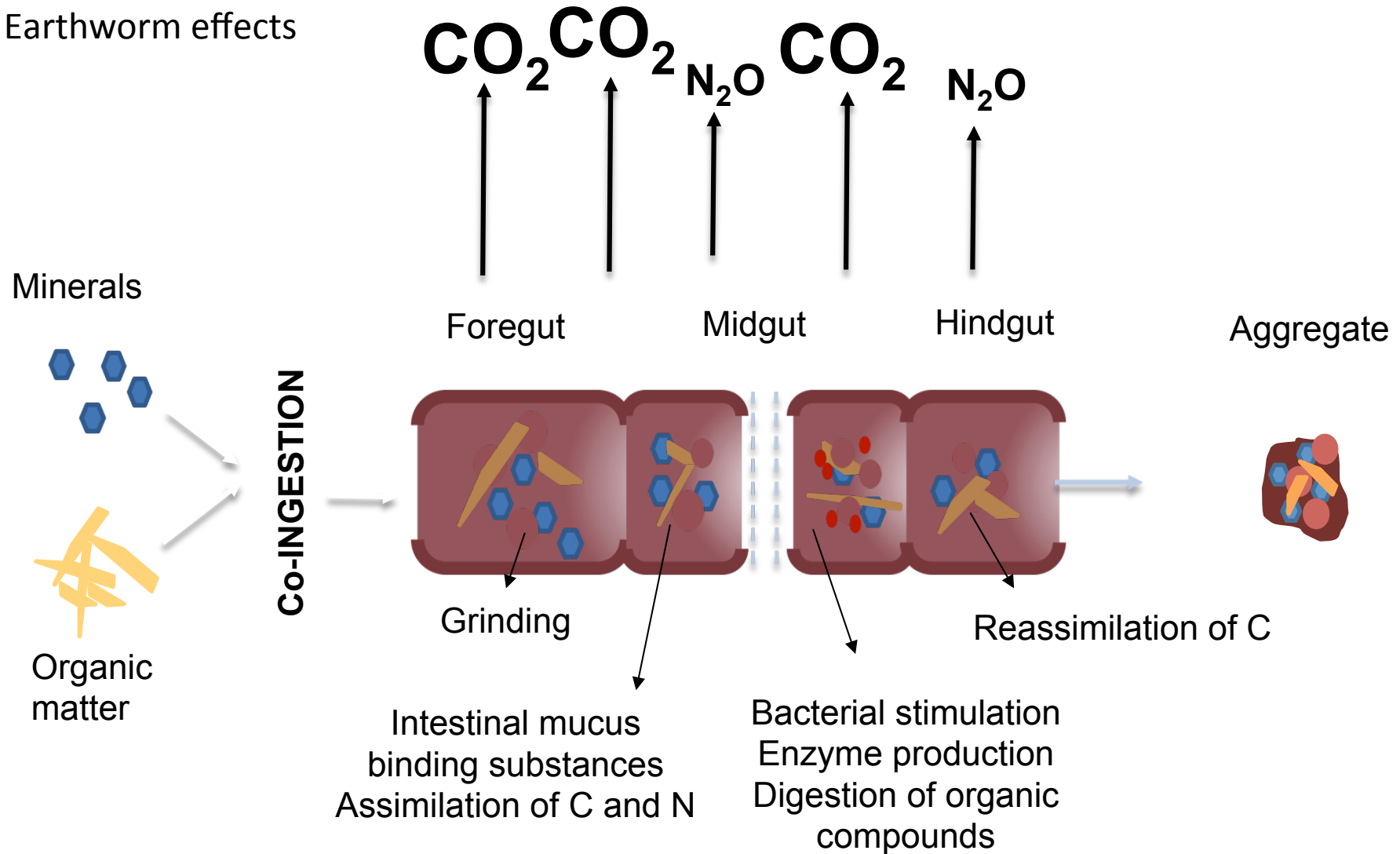
PhD Justine Barthod

Minerals may protect carbon from decomposition by forming organo-mineral associations (Kögel-Knabner et al., 2008)



# Ecotechnology: addition of worms

Earthworm effects



➡ Higher C stability due to stronger binding

# Experimental setup : Degradation experiment (6 months)

Model: Composting system



Fresh organic matter

Addition of minerals  
15% Montmorillonite  
30% Montmorillonite  
15% Goethite; 15% Kaolinite

Addition of worms (*Eisenia andrei* and *foetida*)  
(half of the samples)



**Montmorillonite**  
232 m<sup>2</sup> g<sup>-1</sup>  
pH 3,9



**Goethite**  
11 m<sup>2</sup> g<sup>-1</sup>  
pH 4,8



**Kaolinite**  
7,5 m<sup>2</sup> g<sup>-1</sup>  
pH 7,6

## 1. Monitoring of CO<sub>2</sub> emissions

## 2. Characterisation of end products

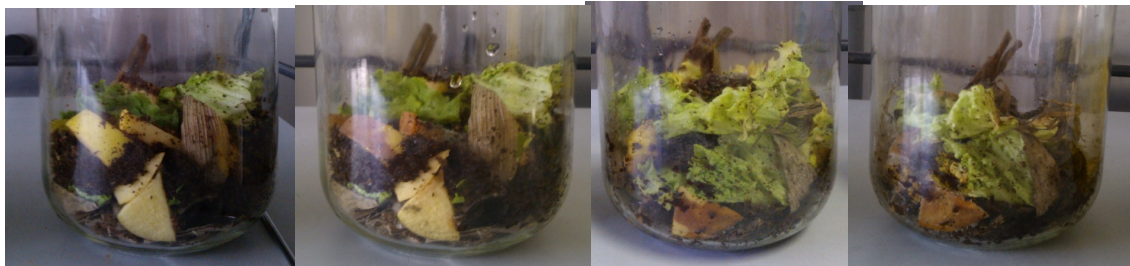
- ✓ Effect on on soil CO<sub>2</sub> emission (80 days)
- ✓ Effect on plants and C flow to soil



# Organic matter evolution

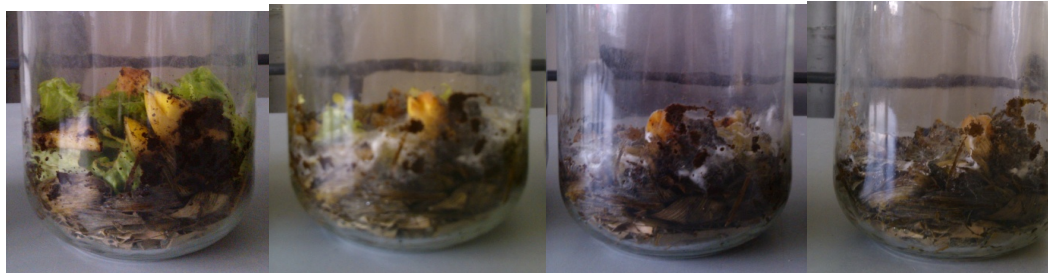
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Compost (C)



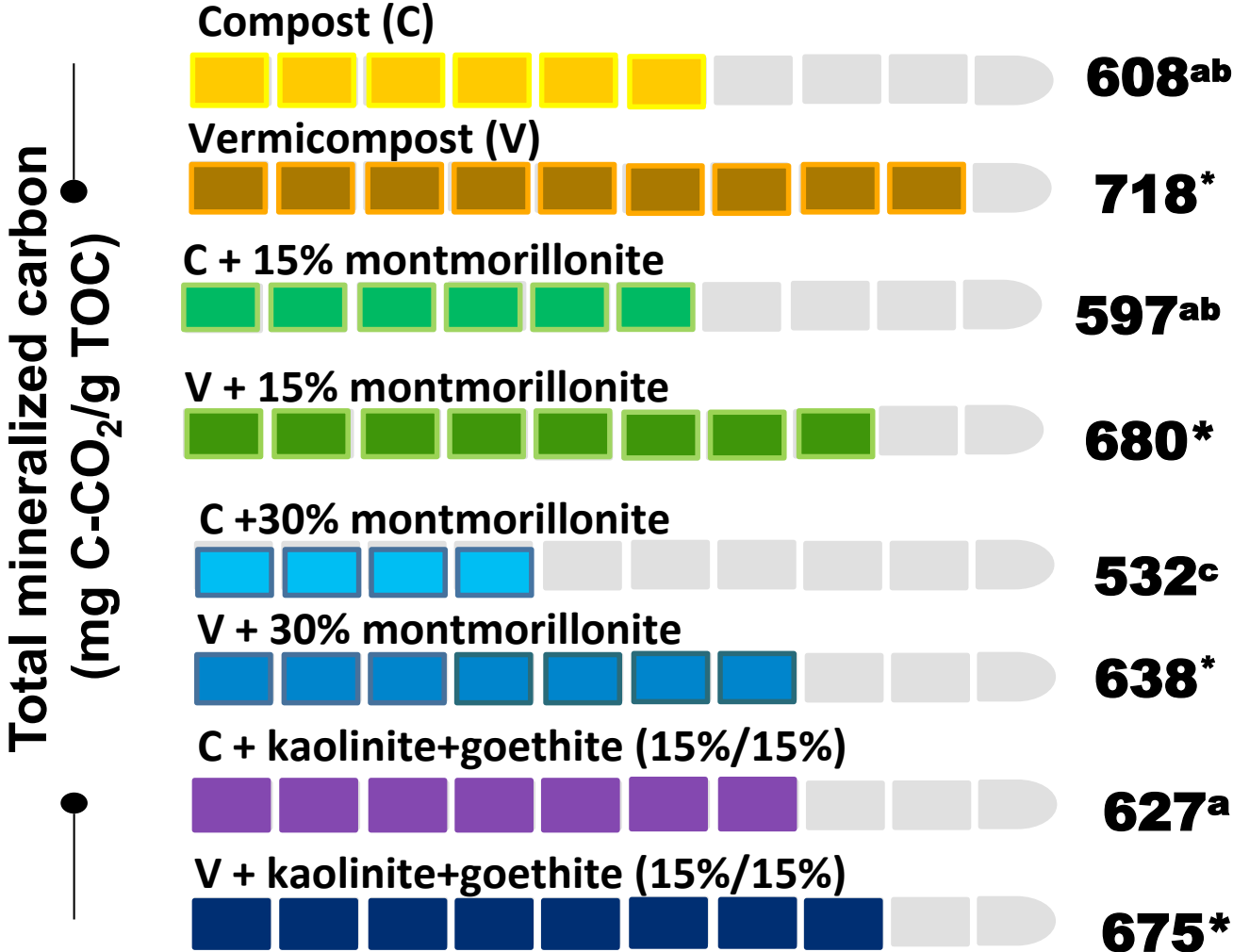
6 mois

Vermicompost (V)





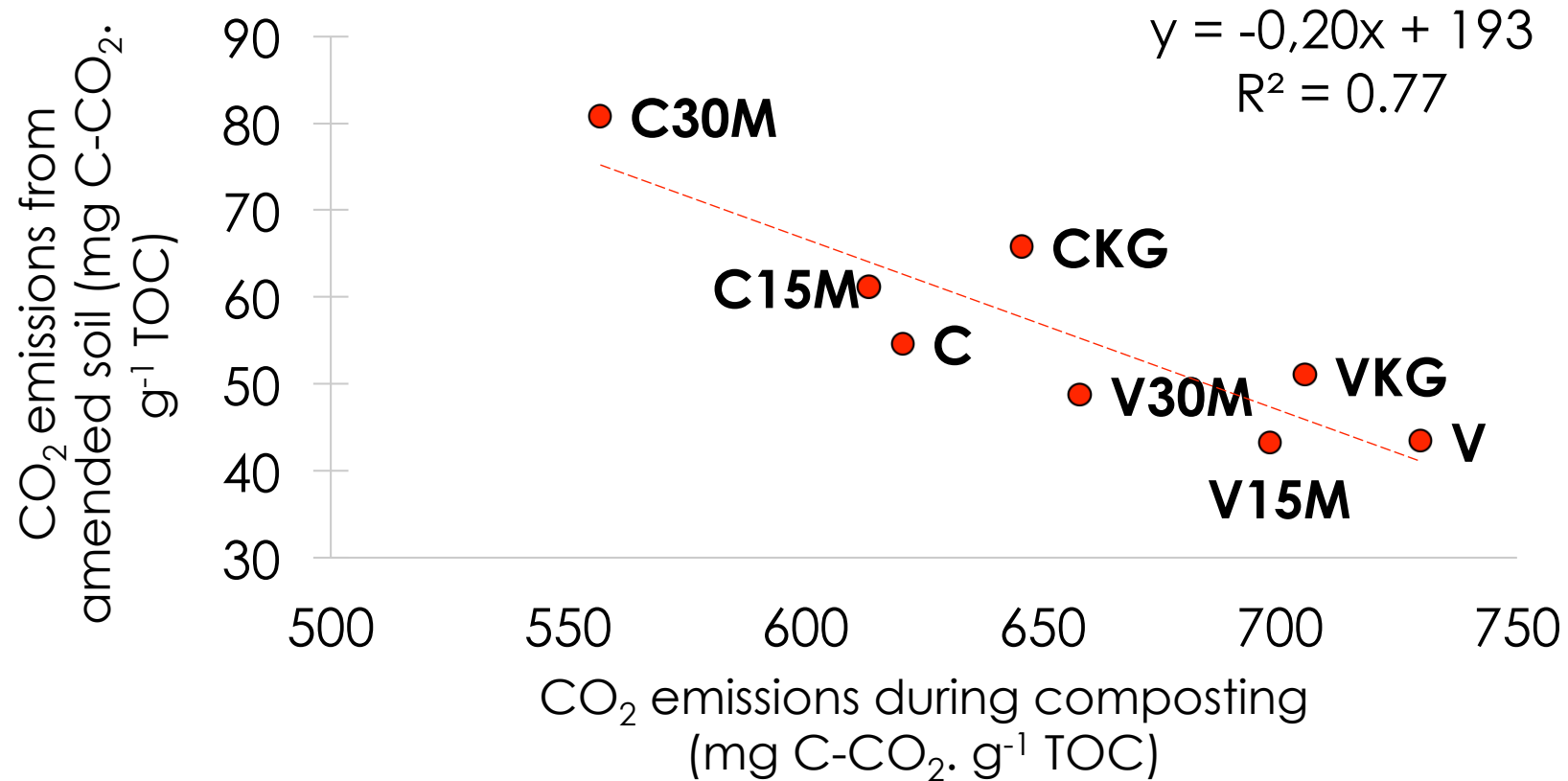
# Carbon mineralisation during 6 months



Highest C losses in worm treatments

Mineral addition decreased C loss in worm treatments

# OC mineralisation after soil application (80 days)



Material which emitted during (vermi)composting is stable after soil application  
Mineral addition during composting lead to higher CO<sub>2</sub> emissions in soil

**How do these materials impact plant growth and rhizosphere processes ?**

# Conclusion

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Ecotechnological approaches using earthworms and minerals may be suitable to reduce CO<sub>2</sub> emissions during composting

Reduction of carbon emissions during composting through mineral additions are depending on mineral type.

Use of earthworms accelerated OC loss during composting but also generated organo-mineral interactions.

After soil addition organic amendments produced in the presence of minerals led to higher CO<sub>2</sub> emissions than mineral-free amendments