

# Changes of soil structure and earthworm community under different agricultural management

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**fnrs**  
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- . Soil is an interactive system, in which characteristics are strongly linked
- . Soil influenced by mesological and anthropic constraints



- . Earthworms drive soil fertility « Ecosystem Engineers » .
- . Environmental conditions and human pressures regulated earthworm dynamics.

**To better understand interactions between all components of soil.**

Industrial scale of  
production



Increase of the  
inputs



Intensification of  
agriculture



?

Decrease of soil  
biodiversity



Decline in soil  
organic matter



Degradation of  
soil quality

**How to sustain soil fertility ?**



**New soil conservation management  
practices are required.**

**Impact of agricultural management on earthworm community and physical properties of soil**



**Soil fauna  
Earthworms**

**1. How is earthworm community influenced by agricultural practices ?**



**Soil structure,  
Physico-chemical  
properties  
of soil**

**2. How are soil properties and nutrient elements influenced by agricultural practices ?**



## Some questions

- Changes in the earthworm community in different cropping systems ?
- Link between agricultural management and earthworms?
- Impact of different agricultural practices on soil properties (Physical / Chemical)?



## Study design

- . Located in Gembloux, Belgium.
- . The experimental design = latin square 4X4 (16 plots: 15\*40 m)

### . Agricultural practices:

- Tillage / Restitution (Tillage IN)
- Tillage / Exportation (Tillage OUT)
- No-tillage / Restitution (No-tillage IN)
- No-tillage / Exportation (No-tillage OUT)

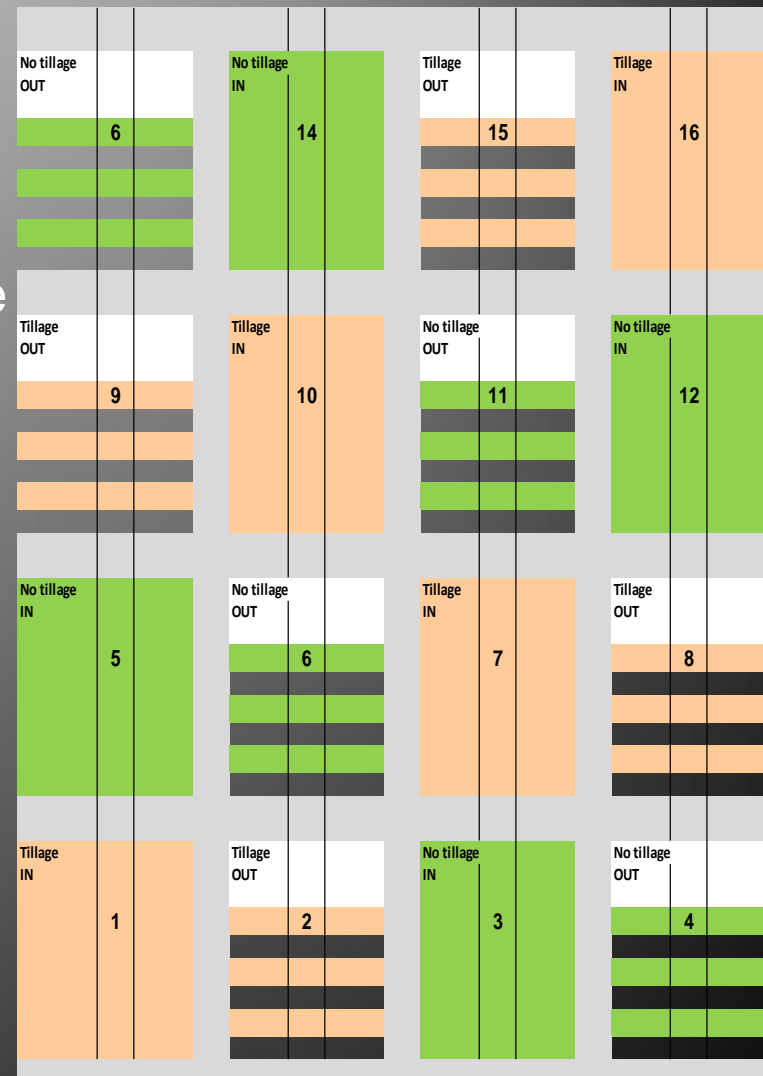


Fig. 1. Experimental design, tillage management, and cropping systems.

## Experimental protocols

### *. Earthworm sampling*



*Metallic cylinder (30 cm diameter, 30 cm depth)*



*Excavation of soil blocks*



*Extraction of earthworms by hand*



*Counting and weighing of earthworms, preservation in formalin 4%*



*Species identification (Key of Cluzeau, 1996)*

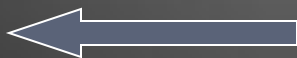
## Experimental protocols

### *. Soil sampling*

*Composite samples from soil plough layer*



*Soil bulk density*



**Soil analysis**

*Total Organic Carbon, pH, ...*



*Nutrient elements  
water- extraction*





**Impact of agricultural management on earthworm community and physical properties of soil**



**Soil fauna  
Earthworms**

**1. How is earthworm community influenced by agricultural practices ?**

### Earthworm abundance and biomass

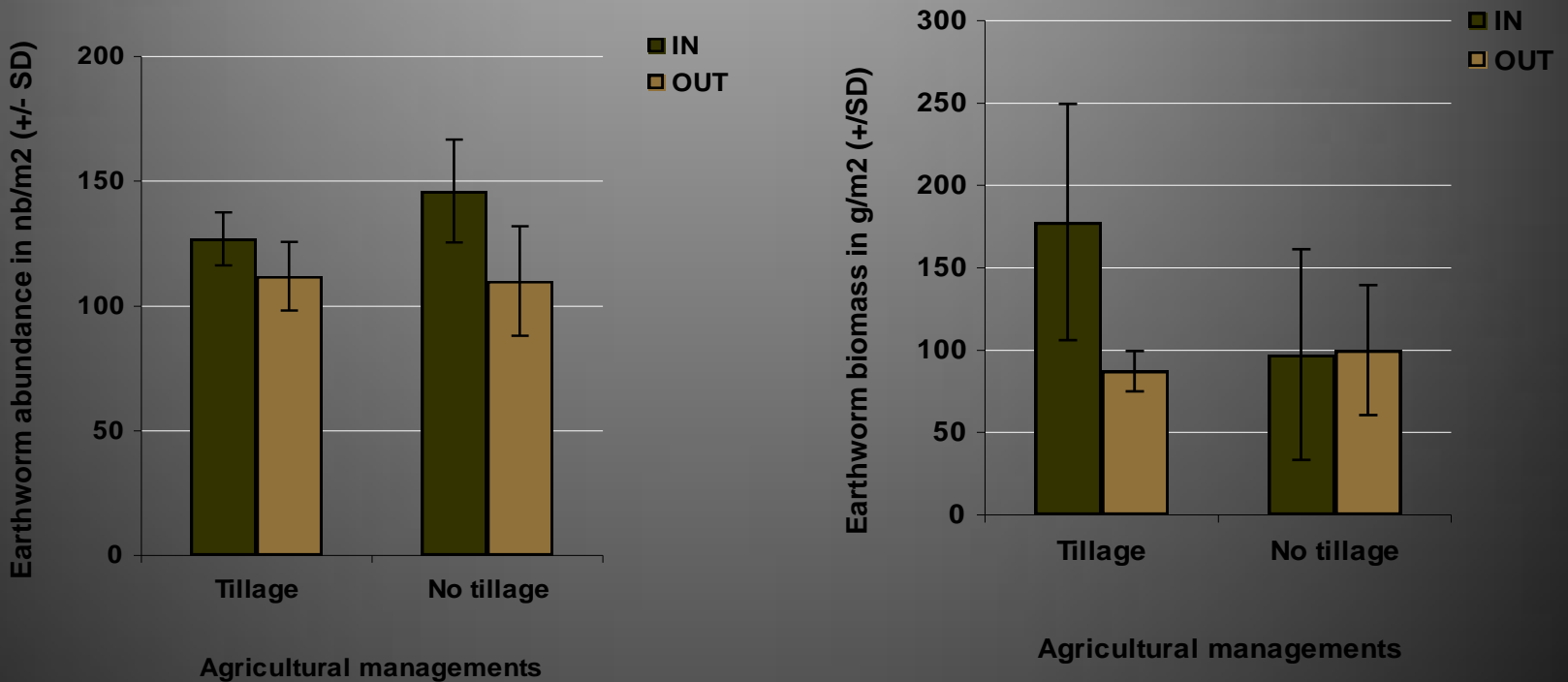
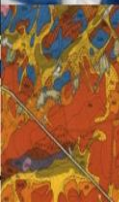


Fig. 2. Earthworm abundance and biomass in four agricultural managements (mean  $\pm$  S.D).

**No significant difference in earthworm abundance and biomass between the four treatments.**

*Earthworm abundance and biomass*

- . Earthworm parameters as abundance and biomass were very low under cultivated soils.
- . Earthworm abundance is affected by tillage system and by absence of crop residues.
- . Earthworm biomass is not affected by tillage practice but by absence of crop residues.
- . **The low value of earthworm biomass = large quantity of juveniles (NT).**
- . **High biomass were linked to the presence of *N. caliginosus meridionales* and *L. terrestris* (T).**



### Earthworm diversity

- . 22 species were recorded from parcels.
- . *L. terrestris*, *Caliginosus meridionales* and *D. rubida* are the most abundant species.
- . Despite their sensitivity, anecic and endogeic species were dominants.
- . Sensitivity of epigeic species to wheat monoculture.

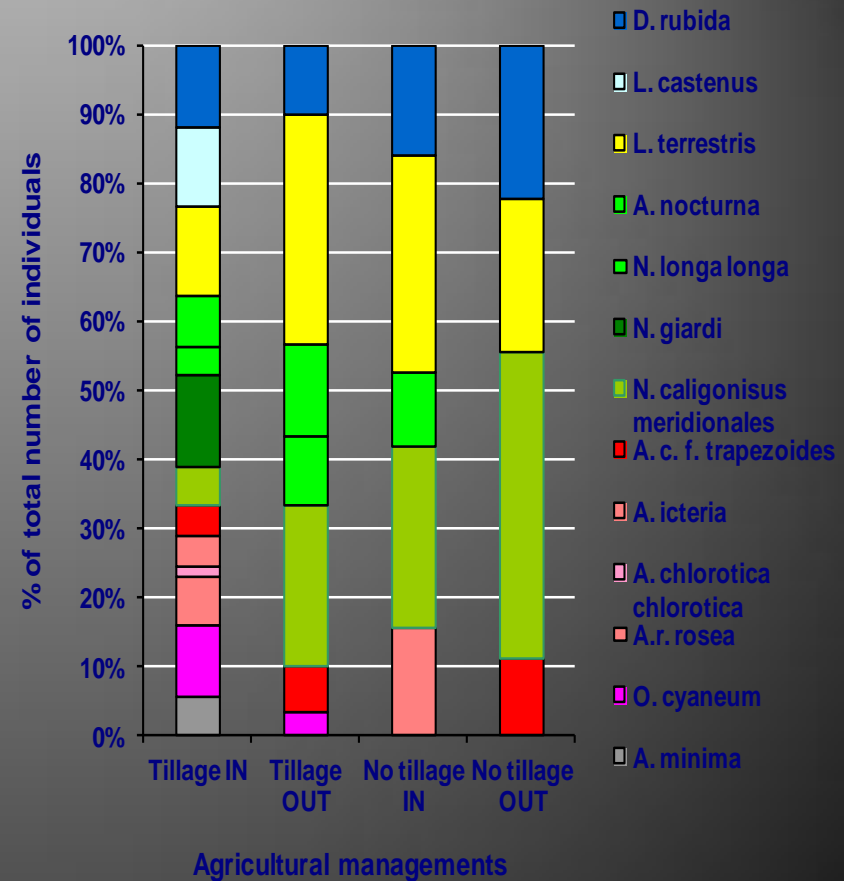


Fig.3. Earthworm species abundance sampled from tilled and no-tilled systems (T: tillage; NT: no tillage; IN: crop residues incorporated in the field; OUT: crop residues removed from the field)

**Impact of agricultural management on earthworm community and physical properties of soil**



**Soil structure,  
physical properties  
of soil**

**2. How are soil  
properties and nutrient  
elements influenced by  
agricultural practices ?**

Soil properties

	T / IN	NT / IN	T / OUT	NT / OUT
<b>Topsoil (0 to 25/35 cm)</b>				
Texture*	Silt Loam (Clay: 14-16% ; Silt : 75-80% ; Sand : 5-6%)			
pH*	Neutral (6,5 – 7,0)			
	TOC* (g/100g) : T / NT		Bulk Density* :T / NT	
0-10 cm				
10-25 cm	1,1	1,3	1,4	1,3
25-35 cm	1,1	1,1	1,4	1,5
	1,1	1,2	1,5	1,4
<b>Structure</b>				
0-10 cm	Gran. + Blck sub.	Gran. + Platy	Platy + Gran.	Granular
10-25 cm	Gran. + Blck sub.	Blck ang.	Platy + Gran	Platy
25-35 cm	Platy	Blck ang.	Blck ang. + Gran.	Platy
<b>Subsoil (35-100 cm): textural B and B to C transition horizons</b>				
Texture*	Silt Loam (Clay : 20-25% ; Silt : 70-75% ; Sand : 3-6%)			
pH*	Slightly acidic (6,2 – 6,5)			
<b>TOC* (g/100g) / Bulk Density*</b>				
	0,1 – 0,5 (decreases with depth) / 1,50 – 1,66			
Structure	Blocky angular to Blocky subangular / Compact			

Table.1. Primary soil properties in the field trial according to regional practices (T: tillage; NT: no tillage; IN: crop residues incorporated in the field; OUT: crop residues removed from the field).

# OVERVIEW

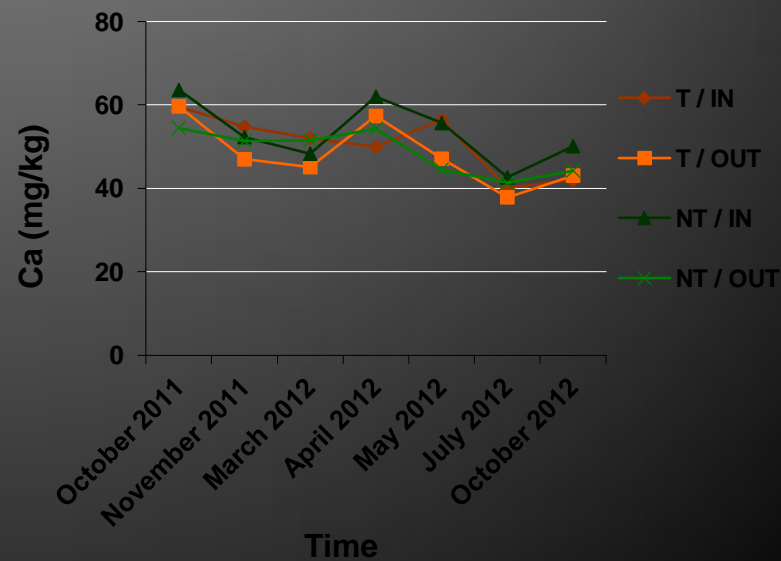
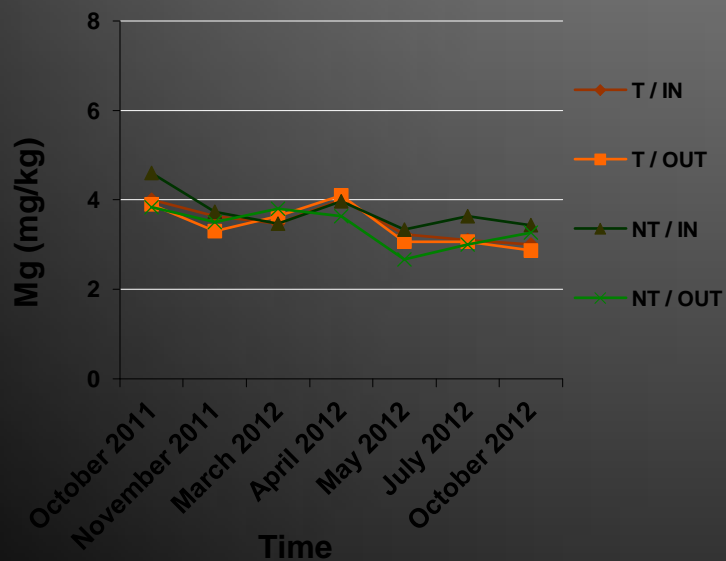
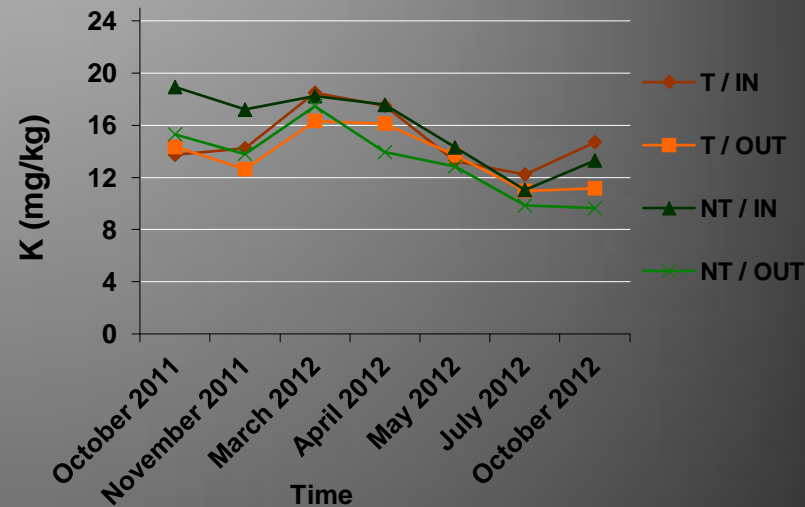
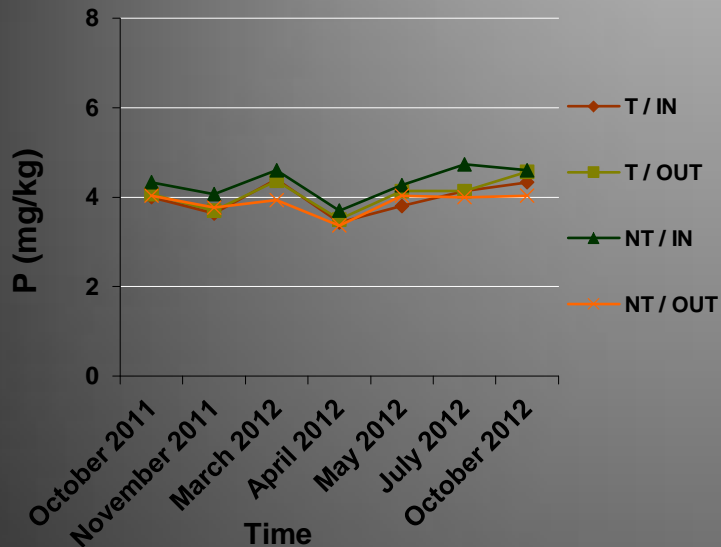
# RESEARCH OBJECTIVES

# MATERIAL AND METHODS

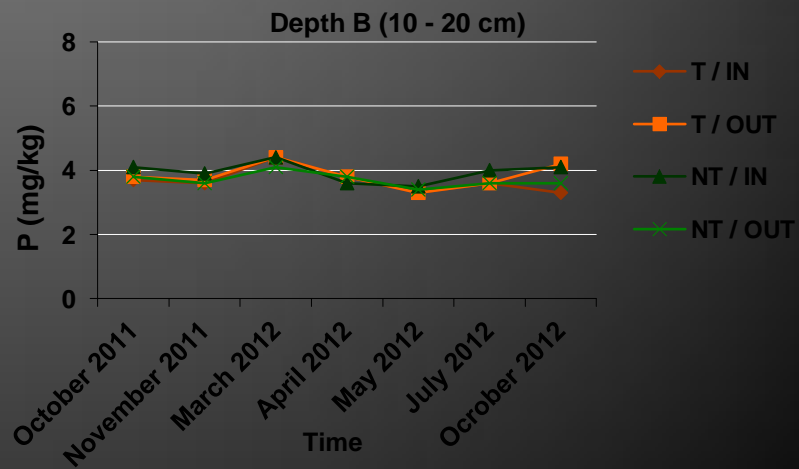
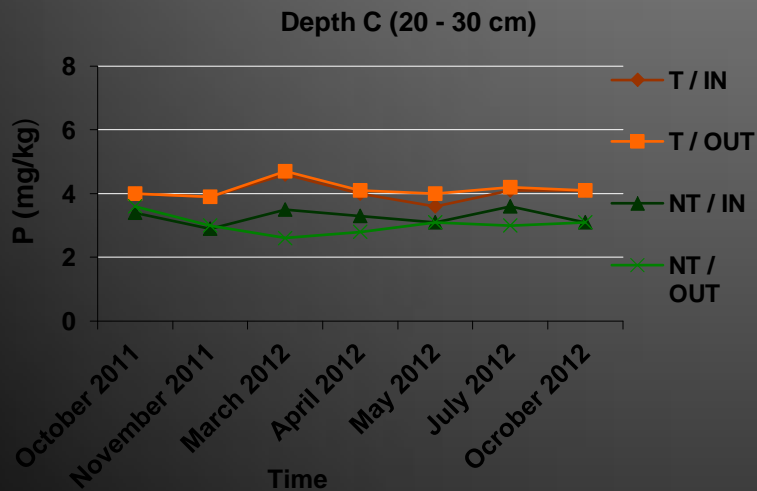
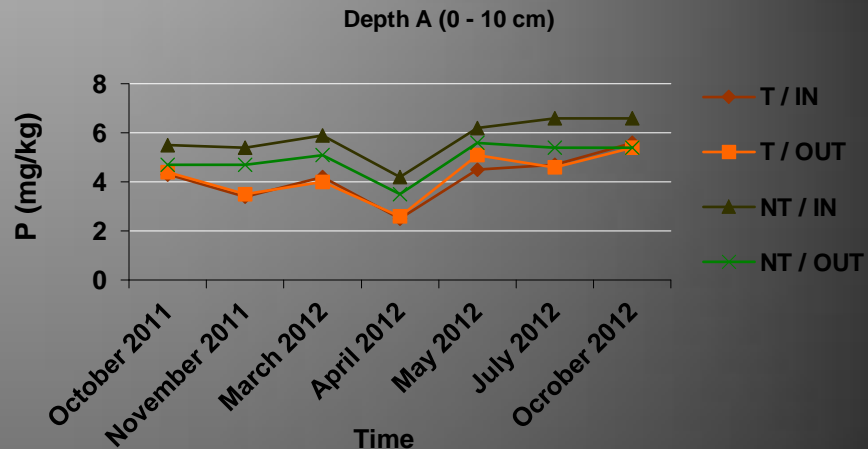
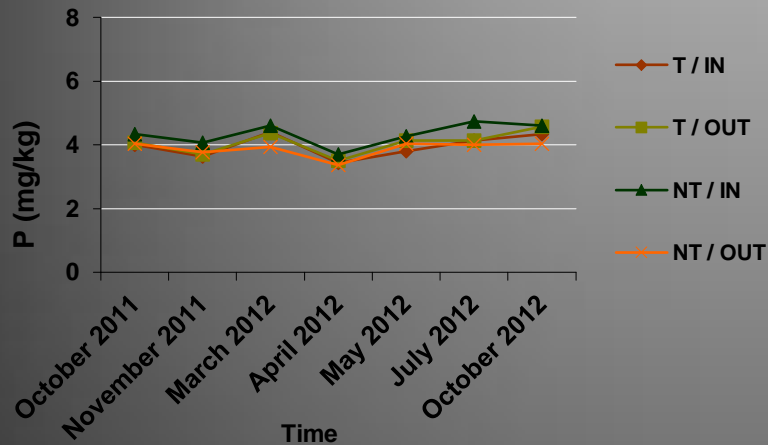
# RESULTS

# CONCLUSION


## Nutrient cycling



Phosphorus example





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- . Our findings don't confirm the negative impacts of soil tillage on earthworm population.
  - . The presence of crop residues can explain the difference between IN and OUT.
  - . In cultivated plots, the agricultural practices don't determine real impact on soil physical and chemical properties.

**More years will be necessary in order to evaluate the long term impacts of cultivation practices on earthworm and soil dynamics.**

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OVERVIEW

RESEARCH  
OBJECTIVES

MATERIAL  
AND  
METHODS

RESULTS

CONCLUSION

*Thank you for  
your attention...*

