Residues management in silty soil : First assessment on crop production

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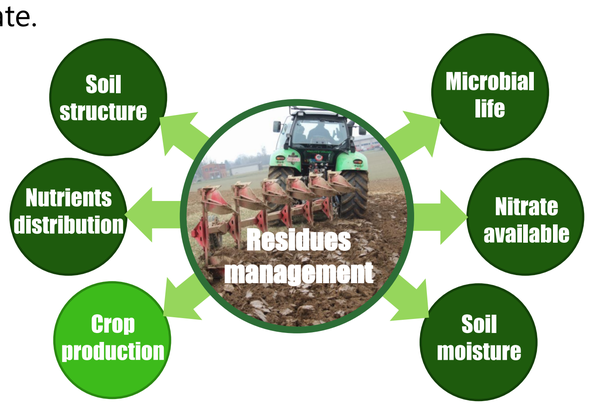
Context & objectives

Crop residues = source of organic matter ⇄ Maintain soil fertility / Export for external uses

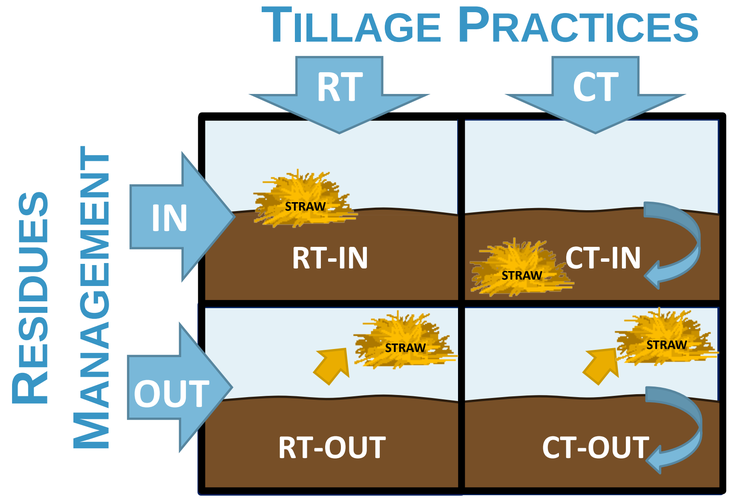
The aim of our project is to **understand all major processes involved in residues management in the soil-water-plant systems** in loamy soil and temperate climate.



In this context **we focus on crop production** after two years of experimentation (Winter wheat in 2011 and 2012).

Materials & methods

A long term field experiment is settled in a loamy soil in Belgium since 20098. Four treatments are tested in relation to the **quantity and vertical distribution of crop residues**.
Crop rotation is the following : rapeseed, winter wheat, **winter wheat (2011), winter wheat (2012)**, faba bean, winter wheat. On each plot, measurements are performed on crop development, weeds and diseases occurrence.



TILLAGE
CT : conventional tillage by moldboard plow at 25 cm depth
RT : reduced tillage by shallow tillage at 10 cm depth

CROP RESIDUES
IN : retention of all crop residues
OUT : exportation of straw

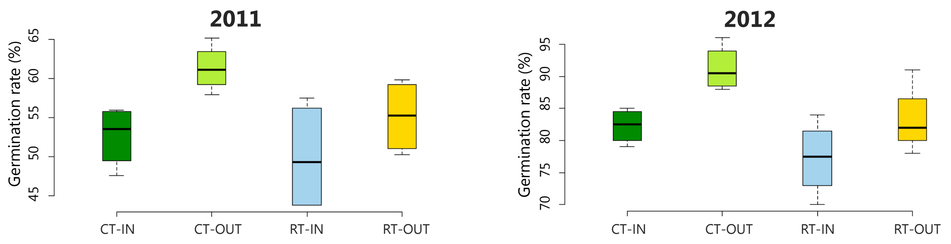
Results

Weather Conditions

Highly contrasted climatic conditions :
2011: unusually dry from February to May
2012: globally beneficial for crop production

Crop Germination

In 2011 and 2012 :
⊕ Influence of conventional tillage (CT)
⊖ Influence of residue retention (IN)



Weeds

In 2011 with poor germination conditions → Rapeseed highly present in CT-IN by a stimulation of seed buried from rapeseed crop in 2009

In 2012 with favorable germination conditions → no effect on weeds occurrence

Plant Diseases & Pests

No residue management effect were observed on the occurrence of plant diseases or pests.

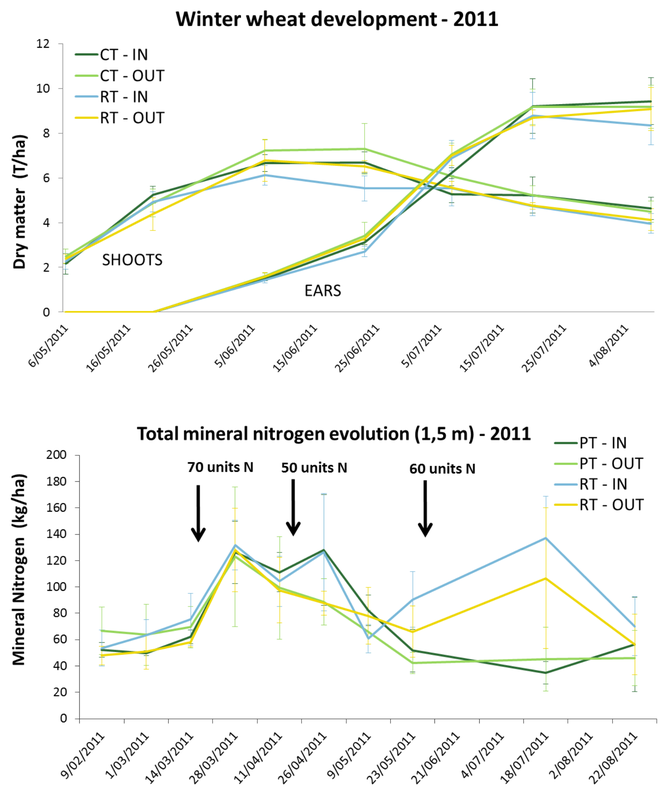
Crop Development & Yield

2011

⊖ effect of drought :
- on crop development whatever treatment
- on mineralization according to Fierer (2003)

After drought :
Biomass accumulation is lower in IN treatments
→ presumably due to stronger microbial activity (Dufranne, 2011) and subsequent competition for nitrogen resources.

Yields :
Lower in RT condition
Could be explained by
→ a delay in vegetation growth
→ a delay in nitrogen uptake by plant after 3rd nitrogen application.

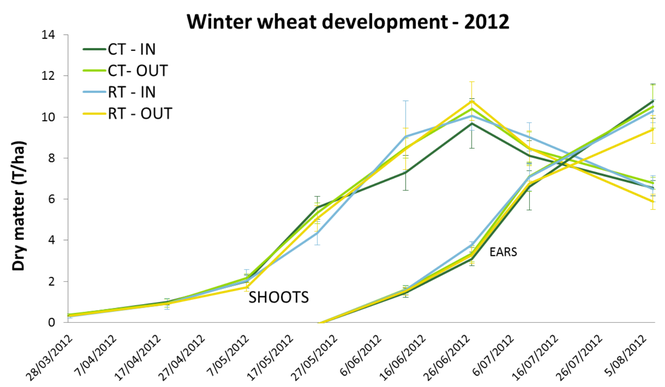


2012

⊕ Weather conditions for wheat growth.

→ Attenuation of differences observed in germination rate.

Yields :
No effect of residue management



Conclusion

→ **Importance of weather conditions** on crop behavior and soil processes.
→ Soil processes require time.

→ Need to extend research with additional years of crop production.
At the end of PhD thesis, 6 years of data will be available. Crop production results will be discussed in confrontation with results of microbial life, soil structure, soil nutrients, water dynamics to deal with residue management in silty soil, temperate climate.

References
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Fierer N., Schimel J.P., Holden P.A. : 2003. Influence of drying-rewetting frequency on soil bacterial community structure. Microbial Ecology, 45(1): 63-71.

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