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Tillage as a tool to manage crop residue : impact on sugar beet production

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Context

Cover crop & crop residue = source of organic matter

TO VALORIZE

- Soil fertility restauration
- Externat uses (fodder, bioenergy,…)

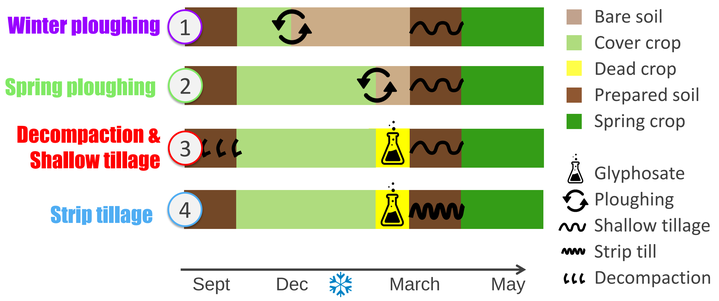
The aim of our project is to **understand all major processes involved in cover crop management in the soil-water-plant systems** in silty loam soil and temperate climate.

In this context **we focus on beat production** from two different experimental fields and weather conditions (2013 and 2014).

Field experiment on cover crop management

Two fields with same protocol but delayed by one year.
Contrasted cover crop managements :

→ Time of intervention	winter	⟺	spring
→ Intensity of tillage	plow	⟺	reduced tillage
→ Cover crop destruction mode	physical	⟺	chemical
→ Main crop soil preparation	100%	⟺	30% disruption
→ Crop residue placement	-25 cm	⟺	-10 cm ⟺ top soil



Results

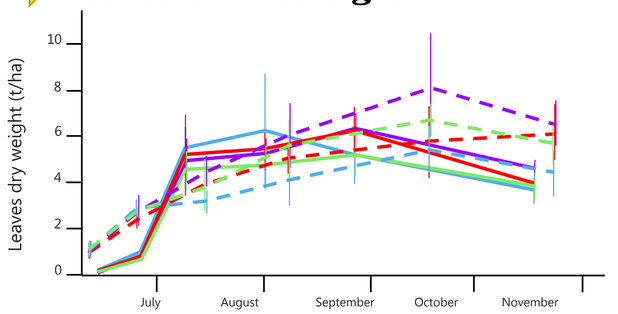
Weather conditions

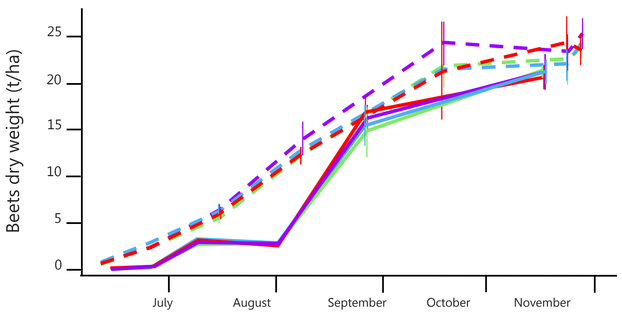
2013: cold spring and dry summer
2014: warm and dry spring, rainy summer

Cover crop

2013: 1,4 t/ha burried in winter ploughing,
1,1 t/ha in other treatments → frost
2014: 1 t/ha burried in winter ploughing,
2 t/ha in other treatments → mild winter

Leaves and beets growth





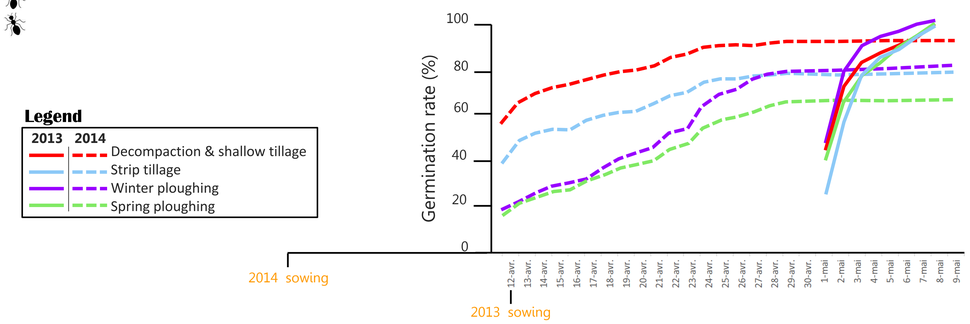
Yield components

	Decompaction Shallow tillage		Strip tillage		Spring ploughing		Winter ploughing	
	2013	2014	2013	2014	2013	2014	2013	2014
Beets yield (t/ha)	80,8	86,7**	79,8	83,4**	79,9	86,9**	81,4	94,4**
Sugar yield	15,12	15,17***	15,12	14,88***	15,08	15,45***	15,34	16,9***
Sugar yield (t/ha) at 16%	94,5	94,9***	94,5	93,0***	94,3	96,6***	96,1	105,6***
Sugar (%)	18,72	17,51	18,94	17,82	18,88	17,78	18,88	17,89
αN	0,79	0,74*	0,81	0,81*	0,92	0,83*	0,80	0,86*
K	3,35*	3,02	3,22*	3,01	3,20*	2,82	3,14*	2,91
Na	0,20	0,24	0,19	0,24	0,21	0,23	0,20	0,24

Significant codes : P < 0,01 '***', P < 0,05 '**', P < 0,1'*'; colors for different statistical group

Germination rate

No effect of modalities in both year BUT rate higher in **2013** and differences in the dynamics.
In **2014** : 17mm of rain in two days → crust formation particularly in ploughing plots.



2013:
- few variations between treatments
- weather influence highly visible

2014:
- high variation inside treatments
- significative differences in leaves (shallow tillage versus winter ploughing particularly)
- but not observable in beets.

Weeds

2013:
- Difference between decompaction (low) and ploughing (high)
- Importance of rotation on rapeseed occurrence
- Diversity in weeds higher in strip tillage

2014:
- Slight effect (P=0,055) of tillage on weed occurrences.
- Higher quantity in strip tillage

Conclusions

- Weather conditions and soil humidity are crucial during sowing period
- Strip tillage is quite technical, not user friendly
- Weather conditions have major impact on crop production
- Difference observed on sizes and shapes on beets during growing season did not impact yield
- Higher yield in winter ploughing in 2014
- No significant differences in 2013
- Tillage has great impact on weed occurrences → importance of knowing cultural past.

In order to fully understand the impact of cover crop management on crop production, further years of experiment are needed due to the high importance of weather on crop development.

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