



**How Tillage and Soil Covering Affect Agro-Environmental Indicators.**  
**Preliminary Results During the Transition from Conventional to Conservation Agriculture**

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**Tillage radish:**

- Wide and deep taproot
- Winter-killed



**Winter wheat:**

- Fibrous root apparatus
- Well adapted to the agroecosystem

		Rep. 1			Rep. 2		
		NT	CT	MT	NT	CT	MT
Tillage systems:	TR	BS	WW	TR	BS	WW	TR
	BS	WW	TR	WW	TR	BS	BS
	WW	TR	BS	TR	BS	WW	WW

Experimental design

**Introduction**

The transition from Conventional Agriculture (CV) to Conservation Agriculture (CA) brings several side effects in the first years. This could discourage its application, especially since transition time duration is uncertain.

**Aim**

Investigate the effects of different soil tillage and soil covering on selected soil agro-environmental indicators, during the transition time from CV to CA, determining benefits and drawbacks of each tillage-soil covering combination.

**Materials and Methods**

**Sustainability indicators**

- Hydraulic conductivity (Ks)
- Bulk density (BD)
- Aggregate stability (AS)
- Earthworm density (EW)
- Soil org. Carbon (C org)
- Yield (Y)

The parameters were sampled in 2 dates (first survey 2019 and second survey 2020), in the shallow soil layer (0-20 cm).

**Agronomic protocol (2018-2020)**

Tillage systems:

- Conventional (CT): plowing and harrowing
- Minimum (MT): harrowing
- No till (NT): sod seeding

Soil covering:

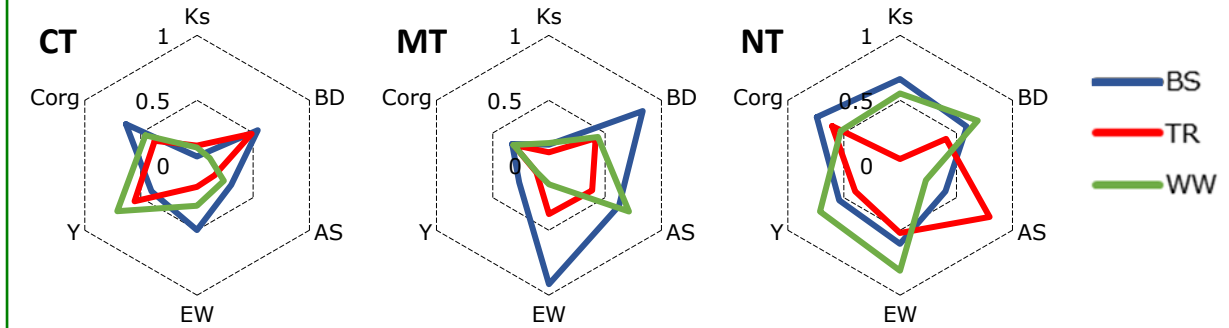
- Bare soil (BS): main crop residues only
- Tillage radish (TR)
- Winter wheat (WW)

Data were normalized to range from 0 (worst result) to 1 (best result).

Treatment combinations reporting high and uniform indicators scores were considered the most sustainable.

**Results**

Treatments combinations average scores in the six indicators are reported in the subsequent radar charts: wider area represents higher sustainability.

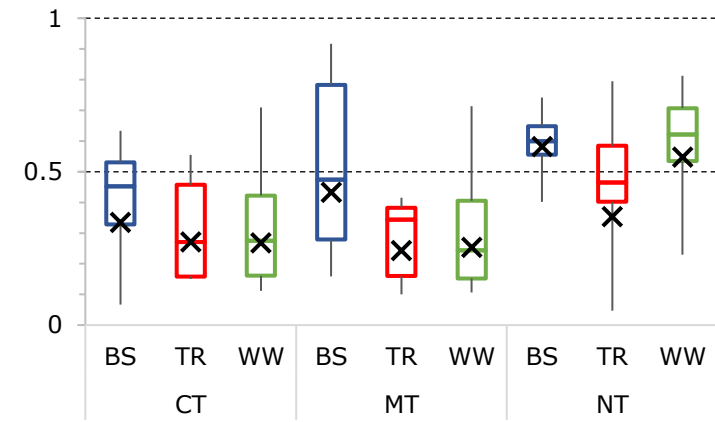


NT combined with BS or WW reported some of the best scores in most of the indicator, except for AS, which performed better when combined with TR. Positive results in AS, BD and EW were also reported in MT-BS combination.

The box and whiskers plot represents the variability among the considered parameters.

NT combined with BS and WW reported the highest geometric mean values (marked with a black x), resulting treatments with satisfactory results in all treatments.

The other combinations presented both lower values and higher variability.



**Conclusions**

- Since the first years after conversion from CV to CA, no tillage seemed effective in improving system sustainability and ecosystem services, both with BS or WW winter coverings.
- The sustainability evaluation was driven by the results in AS, BD, EW and Ks. Otherwise, Corg reported limited differences amongst treatment combinations.
- Minimum tillage combined with BS reported on average good results, but unbalanced among the considered indicators.
- In the short time, the tillage effect apparently masked the soil covering effect.

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