“Alternatives to Glyphosate in conservation agriculture: effects on carbon sequestration in a field experiment in northern Italy”

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SSS10.5 - Sustaining soil functions in organic and inorganic farming – soil quality assessment, processes and models

Thu, 07 May, 14:00–15:45 | D2231
INTRODUCTION

Conservative Agriculture (CA) practices are recognized to enhance soil organic carbon (SOC) stock and in turn to mitigate the effect of climate change.

CA has 3 principles:
• Reduced tillage
• Crops diversification
• Constant soil cover
  with retaining crop residues + cover crops (CC)

In CA, CC are usually terminated with Glyphosate, which determines environmental impacts (Hagner et al., 2019). An alternative is mechanical termination with roller crimper or disk harrow.

OBJECTIVE of the STUDY: Evaluation of the effect of mechanical termination and Glyphosate on carbon sequestration in CA?
METHODS

• 2-year field experiment on an organic farm (Lodi, Northern Italy)  
  CC = Barley, Cash crop = soybean  

• 4 treatments of CC termination + soybean sowing + weeds control in soybean:
  - CONV: Glyphosate + Disk Harrowing (15 cm) + sowing + hoeing
  - ORG-MT: Disk Harrowing (15 cm) + sowing + hoeing
  - ORG-NT: Roller Crimper + Sod seeding
  - CONTR: Disk Harrowing (15 cm) + sowing

• Measured variables:
  Biomass of CC, soybean, weeds in soybean
  SOC (30 cm top soil) at CC termination and soybean harvest

Randomized block design
4 treatments in 3 blocks
Sampling area: 30 m X 12 m in each plot (dashed line)
RESULTS

SOC g kg\(^{-1}\) (top layer of 30 cm)

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2-year average Biomass kg DM ha\(^{-1}\)

CC=Barley

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Soybean

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Weeds in soybean

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Data are treatment mean across blocks.

Data were treated with a mixed model (IBM SPSS 25.0).
DISCUSSIONS and CONCLUSIONS

• SOC change is positively correlated to the CC (barley) biomass.

• CONV (Glyphosate use) resulted in significantly higher CC and soybean biomass at the end of the second year (+32%, p<0.01) because of the higher weeds control.

• CONV allows to stock more carbon via photosynthesis that in turn results in higher SOC content.

• As a short term result, SOC under ORG-NT (ruller crimper + sod seeding) resulted in low SOC accumulation due to the scarce contact between CC litter and soil particles (limited microbial decomposition).

• If we consider the tractor fuel consumption in the treatments along with the biomass production, the carbon sequestration did not vary between CONV and the mechanical treatments.

• Further studies are needed for the definition of optimized field management practices to reduce the passage of machinery while increasing crop production and SOC.