

# Romania study site experiment 1: EXPERIMENTING WITH TILLAGE FOR IMPROVING SOIL HEALTH

## The problem

The study site is located in the arable land of Draganesti Vlasca commune. Draganesti Vlasca is located within Burnas Plain in the eastern part of Teleorman county, Romania. The crop rotation here is: winter wheat, mustard, sunflowers.

The dominant soil in Draganesti Vlasca is phaeozem. The main soil threats here include low fertility, compaction and erosion risk.

This experiment was undertaken to explore the potential of different tillage practices in tackling these threats.

## Experimental design

### Measurements taken

- Max. rooting depth (control physical limitation)
- Water holding capacity
- Soil aggregate stability
- Bulk density / total porosity
- Penetration resistance - measured twice
- Texture
- Chemical indicators: - N mineral, P total, Extractable P, K, Ca, Mg, Organic carbon, pH, EC
- Pesticides, heavy metals

## Treatments

This experiment explored whether different tillage practices, including mouldboard ploughing with furrow inversion, subsoiling, disking and chiselling, would result in soil health improvements.

**Field operations:** The experimental field was fertilized every spring with a complex fertilizer NPK 15:15:15 and also 2 kg/ha Glyphosate was applied during May.

Treatment	Ploughing	Subsoiling	Chiseling	Disc
Rotation 1 (Maize, soybean, barley)	Y			
		Y		
			Y	
				Y
Rotation 2 (winter wheat, mustard, sunflower)	Y			
		Y		
			Y	
				Y
Rotation 3 (spring barley, maize, soybean)	Y			
		Y		
			Y	
				Y



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## Results

Figure 1. Crop yield (kg/ha) versus treatments. The SICS treatments led to high variability in crops yields. In general, the treatment where subsoiling was applied led to production increases, while the treatments where disking and chiselling were done led to production decreases. These results were significant but irregular, with subsoiling (R1) resulting in the highest yields in y1 and the lowest in y3.

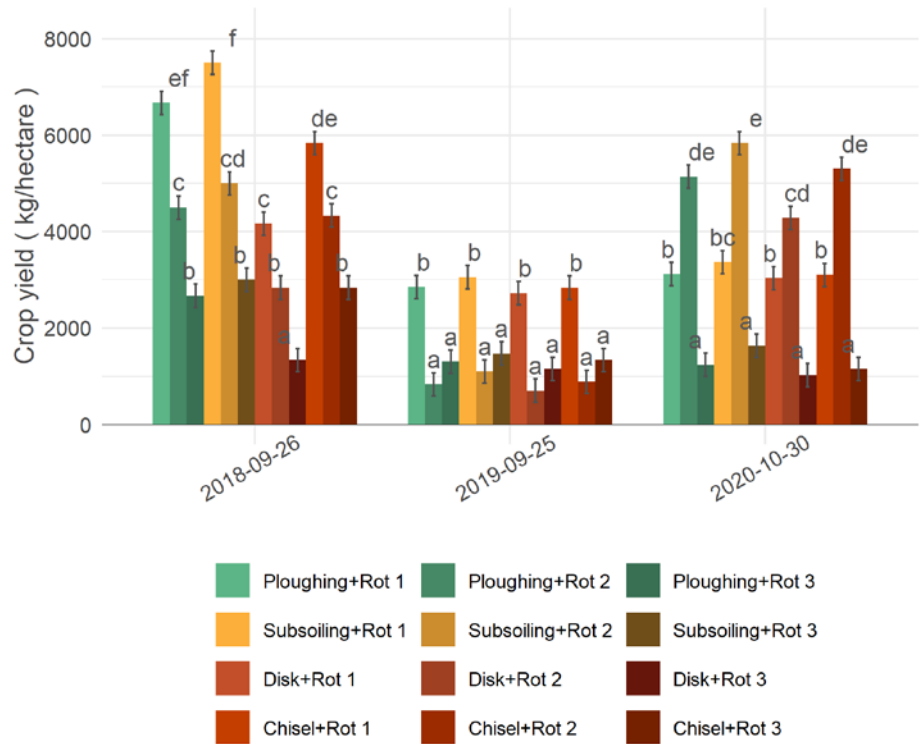
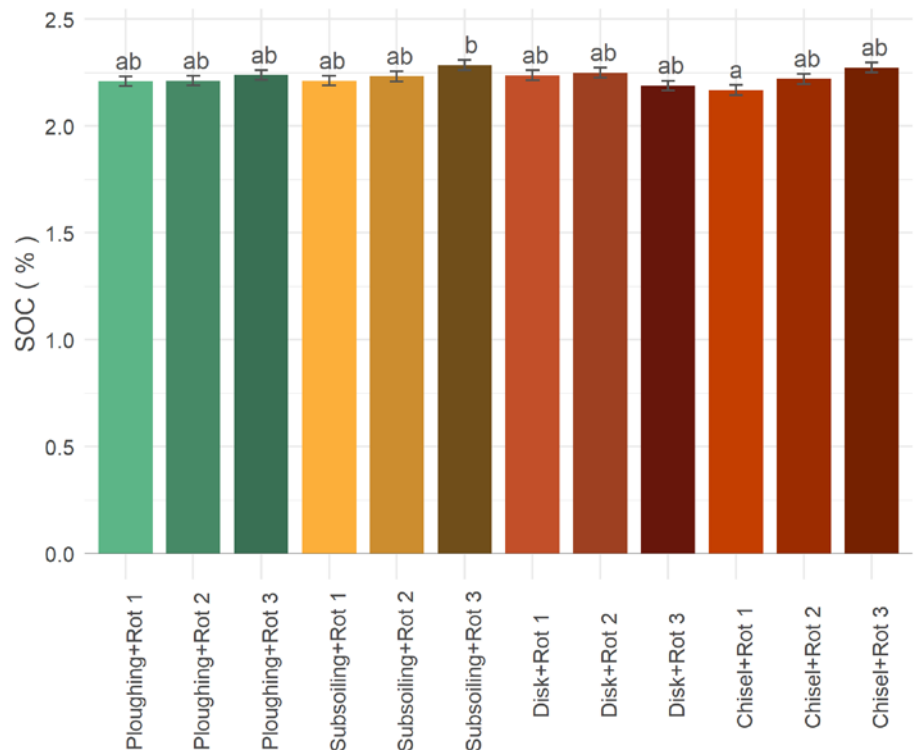


Figure 2 Soil organic carbon (SOC, %) versus tillage treatment. Soil organic carbon content did not vary between the applied treatments, the content being moderate within all 3 experimental years. The investigated soil was highly supplied with available phosphorus, while for the potassium content the soil was low to moderately supplied.



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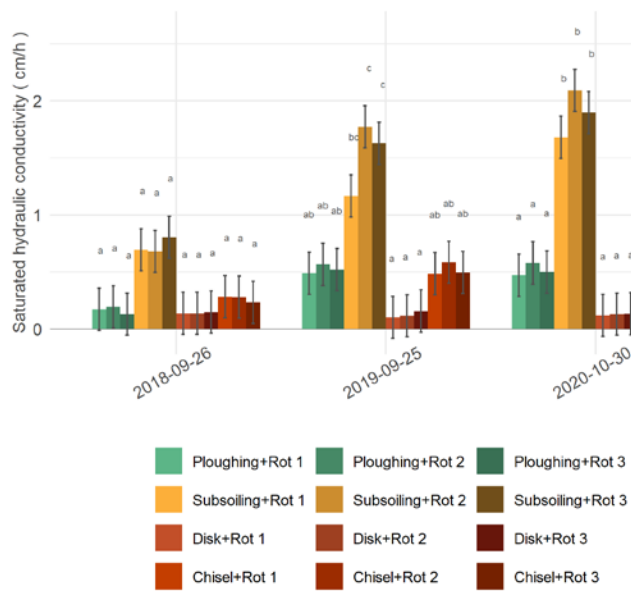


Figure 3. Kstat versus tillage treatment. Hydraulic conductivity was significantly higher in subsoiled plots.

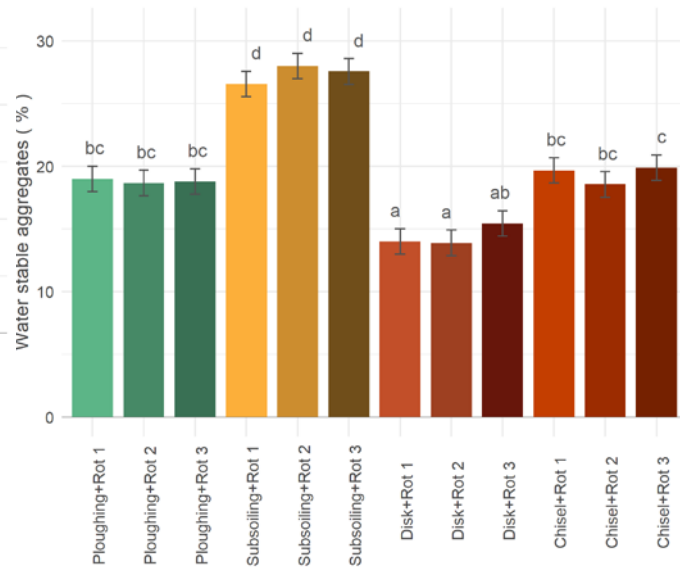


Figure 4. Water stable aggregates (%) versus treatment. Significant differences were found, with subsoiling resulting in the highest WSA

Regarding the chemical characterization of the studied soil, there were no significant variations between the applied treatments and also between the 3 analysed years. The soil reaction values in case of all treatments highlighted a lightly acid soil.

## Stakeholder analysis

Based on the stakeholders analysis of the tested SICS in our study site area, the best SICS for alleviating subsoil compaction is to use a combination of two out of the three SICS treatments: the application of the mouldboard ploughing annually and of the subsoiling periodically at 3-4 years.

Subsoiling periodically prevented the formation of the hard pan layer at the base of tillage depth. In addition, on clayey soil, it can be used in crop rotations with deep rooting system crops / legumes.

These deep rooting crops (e.g., legume) can improve soil quality by increasing the structural aggregation. This results in increases in soil aeration and water infiltration.



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## Key findings

- Different tillage practices resulted in varying crop yields; for example, subsoiling (R1) resulted in the highest yields in y1 but the lowest in year 3. This was likely due to variation in weather between treatment years
- Subsoiling and chiselling led to the highest increases in soil organic carbon levels, as were Kstat levels.
- This experiment suggests that subsoiling is the most beneficial for resulting in soil structure improvements.
- Subsoiling must, however, be carried out at the right time and only on soil types suited to this practice.
- Conventional tillage can result in soil compaction so alternative practices should be explored.
- A longer term experiment is warranted to determine whether the fluctuations in crop yield persist over longer periods of time.



## Fact sheet authors

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## Conclusions

In this case study, the main soil threat was natural subsoil compaction. Mouldboard ploughing SICS may be a solution for compaction alleviation, and was also the practice recommended by stakeholders. This can be effective where it is done under optimum water range for workability and trafficability, low weight machinery are used and low tyre pressure, controlled traffic, use of deep rooting system crops/legumes in crop rotation.

Another solution for mitigation of the natural subsoil compaction on clayey soils may be the application of subsoiling. It was, however, recommended by the stakeholders that this tillage type should be done every 3-4 years.

Another measure for soil quality conservation and compaction mitigation recommended by the stakeholders was the use of leguminous crops/deep rooting system crops in crop rotation. This can be an appropriate measure for nitrogen fixing in soil, which results in decreasing the chemical fertilizers doses for the next cultivated crop in rotation. The leguminous crops also improve soil quality by increasing the structural aggregate stability leading to a good soil aeration status and water regime.

## Contact information

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