CAMA PROJECT FACTSHEET

Benefits of Conservation Agriculture on soil erosion control

CONTEXT

Importance of soil erosion as a main degradation process in Mediterranean countries

One of the main strengths of conservation agriculture (CA) is its benefits on soil quality through the synergies created between crop diversification, residue coverage and minimal soil disturbance (Kassam et al. 2022). Among the different soil functions and ecosystem services defined, nutrient cycling and soil conservation are two of the most important, especially in semiarid Mediterranean conditions where soils are prone to suffer degradation mainly from soil erosion and low soil organic matter (García-Ruiz, 2010). One of the objectives of the CAMA project is to assess the impact of CA adoption on soil erosion mitigation in different countries of the Mediterranean basin. It is well known that the effectiveness of CA on the improvement of soil functions and the delivery of ecosystem services is site dependent. For this reason, it was key to assess the real impact of CA on different soil and climate conditions of the different CAMA countries. In this sense, the positive effect of CA on soil erosion protection was evaluated in four long-term experiments (>10 years) located in the next countries: Spain, Morocco, Tunisia and Italy.

Fig. 1. Soil erosion effects in cropland systems in rainfed Mediterranean Spain.

WORK DONE AND RESULTS OF CAMA

Effectiveness of CA to control soil erosion

The measurement of direct soil erosion rates in the field requires special infrastructure (sediment and runoff collectors), making it difficult to implement in experiments already started. Accordingly, to overcome this limitation, the next soil proxies of soil erosion were selected and measured: crop residue dynamics (residue biomass and residue coverage), particle size distribution, soil aggregate stability and soil hydraulic properties.

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As it is observed in Fig. 2, **no-tillage systems (NT) resulted in greater crop residue biomass and coverage compared with conventional tillage (CT).** This fact implies a **greater protection of soil surface against erosion** processes such as rainfall or wind. This conclusion obtained in the study of crop residue dynamics is also confirmed assessing the differences in soil aggregation between tillage systems. In Table 1, it is observed the **greater soil aggregate stability under NT systems compared with CT**. The greater soil aggregate stability leads to a greater protection of soil against erosion processes.

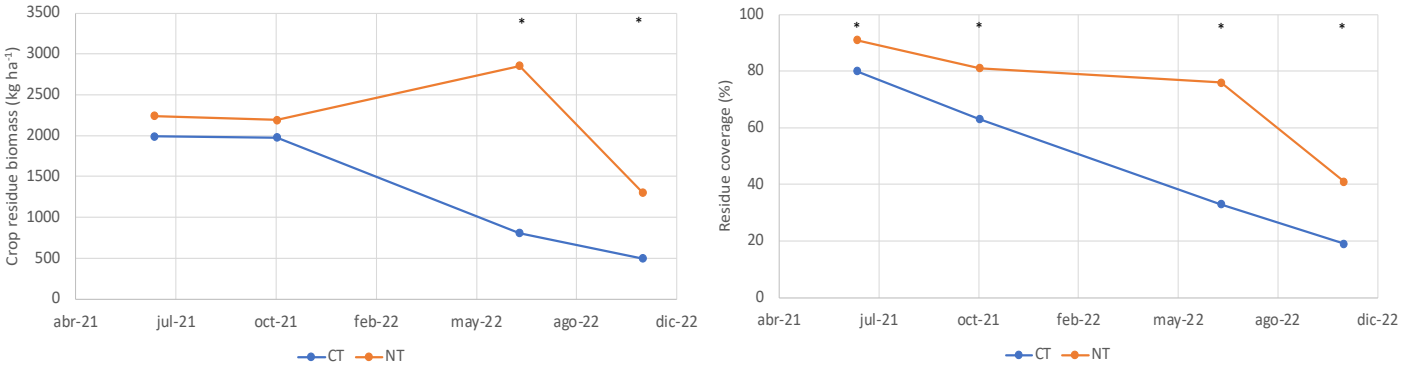

Fig. 2. Crop residue dynamics: biomass (upper graph) and coverage (lower graph) for different tillage systems: conventional tillage (CT) and no-tillage (NT) in July 2021 (post-harvest), November 2021 (pre-sown), July 2022 (post-harvest) and November 2022 (pre-sown) in a long-term experiment located in Spain

Table 1. Soil aggregate stability, measured with the next three tests: FW (fast wetting), SW (slow wetting) and MB (mechanical breakdown), for two tillage systems: conventional tillage (CT) and no-tillage (NT), in Morocco (mean ± standard deviation).

Parameter	Tillage	Soil depth (cm)		Mean
		0-13	13-26	
FW (mm)	CT	0.48 ± 0.01	0.67 ± 0.00	0.57± 0.09
	NT	0.87 ± 0.05	1.16 ± 0.05	1.14 ± 0.07
SW (mm)	CT	0.84 ± 0.04	1.05 ± 0.05	0.94 ± 0.11
	NT	1.36 ± 0.03	1.17 ± 0.03	1.38 ± 0.08
MB (mm)	CT	0.86 ± 0.06	1.11 ± 0.05	0.98 ± 0.09
	NT	1.78 ± 0.05	1.63 ± 0.03	1.68 ± 0.12

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CONCLUSIONS AND RECOMMENDATIONS

According to the results obtained in the CAMA project, the **adoption of the no-tillage system is an adequate strategy to increase soil protection against to soil erosion in rainfed Mediterranean agroecosystems**.

The following should be promoted:

- The **elimination of tillage implements** specially soil inversion implements such as mouldboard plough.
- The **facilitation of a crop residue layer** which covers the entire soil surface **all year around**.
- **Avoidance of the removal of crop stover** from the field.

References

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