

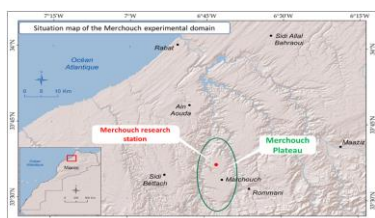


Introduction

In Morocco, agriculture remains an important sector of the economy, accounting for 15 to 20% of the Gross Domestic Product [1]. However, it experienced several constraints: intensive plowing of the land leading to the acceleration of water erosion seriously threatening the water and soil potential of the country, the low density of plant cover, the impact of climate change, etc. Indeed, poor control of conventional agricultural practices causes a decrease in organic matter content and destroys the stability of soil aggregates. The major objective of adopting direct seeding in Morocco is to ensure better conservation of water and soil in the context of climate change as well as to increase agricultural yields, limit evaporation and improve soil quality, especially organic matter and structural stability. Several research studies affirm that organic matter allows the proper functioning and sustainability of agroecosystems [1; 2; 3]. The objective of this study is to characterize the impact of cultural practices on structural stability (SS), organic matter (SOM), moisture (θ_g) and bulk density (BD) of the soil. Two types of tillage were compared: conventional tillage (CT) and no till (NT), based on a chickpea-soft wheat rotation.

Materials and methods

The experimental site is located in the Merchouch experimental area of the Regional Center for Agronomic Research of Rabat (INRA) (Picture 3). The regional climate is semi-arid with moderate winter precipitation. The annual average temperature is 23 °C. The average annual precipitation reaches 394 mm [4]. The monthly interannual averages of precipitation and temperature over a period of 40 years (1978-2018) are presented in Figure 1. The soil is Vertisol type, rich in clay, more soil characteristics are given in Table 1. The trial has been installed for thirteen years with a legume/cereal rotation.



Picture 1. Location of the study site in Morocco and the Zaer region [4]

Table 1. Soil grain size characteristics for NT and CT systems [4]

Texture (%)	NT	CT
Clay	55.7	55.9
Silt	28.9	30.3
Sand	15.4	13.8
Type of soil	Vertisol	

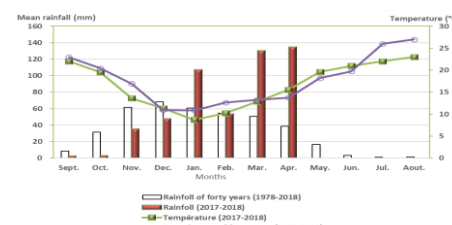


Figure 1. Interannual monthly averages of precipitation and temperatures at the Merchouch station for 40 years (1978-2018), compared to monthly values for the year 2017-2018 [4]

Methodology

The work of the soil consists of a CT (cover crop) carried out in plowed plot; this is the primary plowing (10 to 15 cm deep) to prepare the seed beds and to bury the residue. On the other hand, in a non-plowed plot, the only tillage operation consists of an opening of 2 to 3 cm from the ground to place the seed at a depth of 5 cm, carried out by a special seeder for NT.

Soil analysis

Three measurements were taken for each soil sample to assess the accuracy of the physical and chemical analysis. The Walkley and Black method helped determine the SOM (Walkley and Black, 1934). Grossman and Reinsch's calibrated cylinder method evaluated BD. The Le Bissonais method determined the SS. The gravimetric method to quantify θ_g of the soil.

Results and discussion

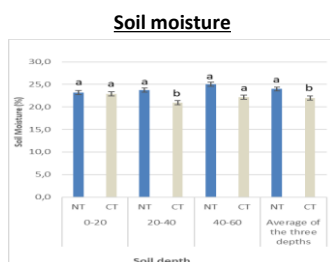


Figure 2. Effect of the two cultural practices (NT and CT) on humidity in percentage [4]

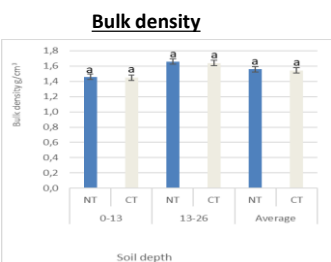


Figure 3. Effect of tillage on bulk density in the 0-13 and 13-26 cm depth for NT and CT [4]

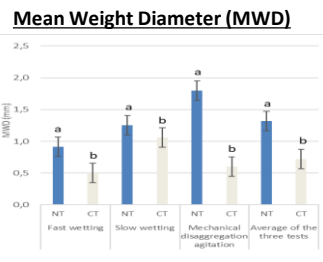


Figure 4. Effect of tillage on Mean Weight Diameter (MWD) for three tests on the soil surface (0-20cm) [4]

Table 2. Effect of tillage on SOM content [4]

Field	Number of NT adoption years	Soil depth (cm)	Soil organic matter (%)		Rate of change (%)
			CT	NT	
Site of Merchouch	13 years	0-5	1.35 ± 0.14b	1.81 ± 0.24a	34
		5-10	1.37 ± 0.16b	1.68 ± 0.31a	23
		10-20	1.25 ± 0.18b	1.55 ± 0.27a	24
		20-40	1.10 ± 0.24b	1.43 ± 0.21a	29
		40-60	1.00 ± 0.26b	1.25 ± 0.18a	26

Conclusion

The work presented consists of the study of the impact of NT on the physicochemical properties of the soil, in particular SOM, θ_g , BD and SS in semi-arid zones. The results obtained show that the use of the SD system positively influences the accumulation of SOM on the soil surface (0-5cm). Concerning the θ_g , there is a significant difference between the two treatments (NT and CT) at the average of the three depths and especially at the 20-40 cm horizon so the NT increases the water retention capacity. This study also shows that the DMP of the 3 tests (Water, ethanol and rewetting) is high for NT compared to CT, this shows that NT helped build good soil structure over time, which is highly desirable for to improve agricultural productivity and to conserve natural resources, especially water.

Bibliography

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