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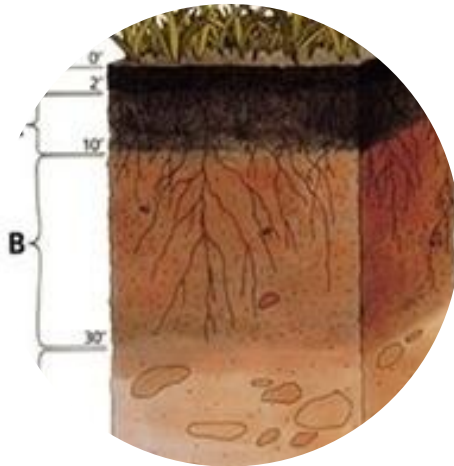
Agroforestry potential impacts on agricultural land fertility of foothills North-West of Dahra (Mostaganem, Algeria)

Presented by :

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Agricultural lands of the Dahra foothills are severely degraded due to the influence of a mismatch between a semi-arid climate and the cropping systems practiced posing a threat to soil conservation and biodiversity valuation as well as for sustainable rural development in the area.



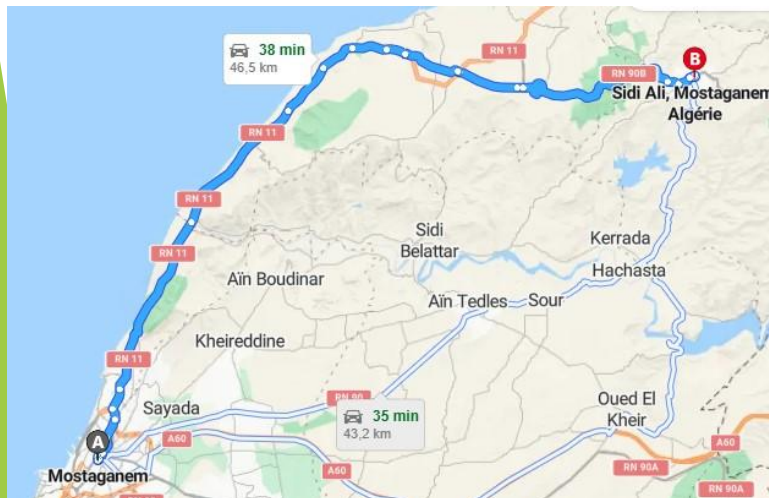
The decline in organic matter (OM) concentration in agricultural soils poses a significant threat by reducing soil fertility, which in turn directly impacts agricultural productivity (Eden et al., 2017).

In this context, the evaluation of the physicochemical properties through peasant fields, and the determination of soil fertility indicators in agroforestry systems compared to other systems as a non agroforestry comparator, such as conventional agriculture systems (Castle et al., 2021) were the subject of our study

POURQUOI PAS MOI ?



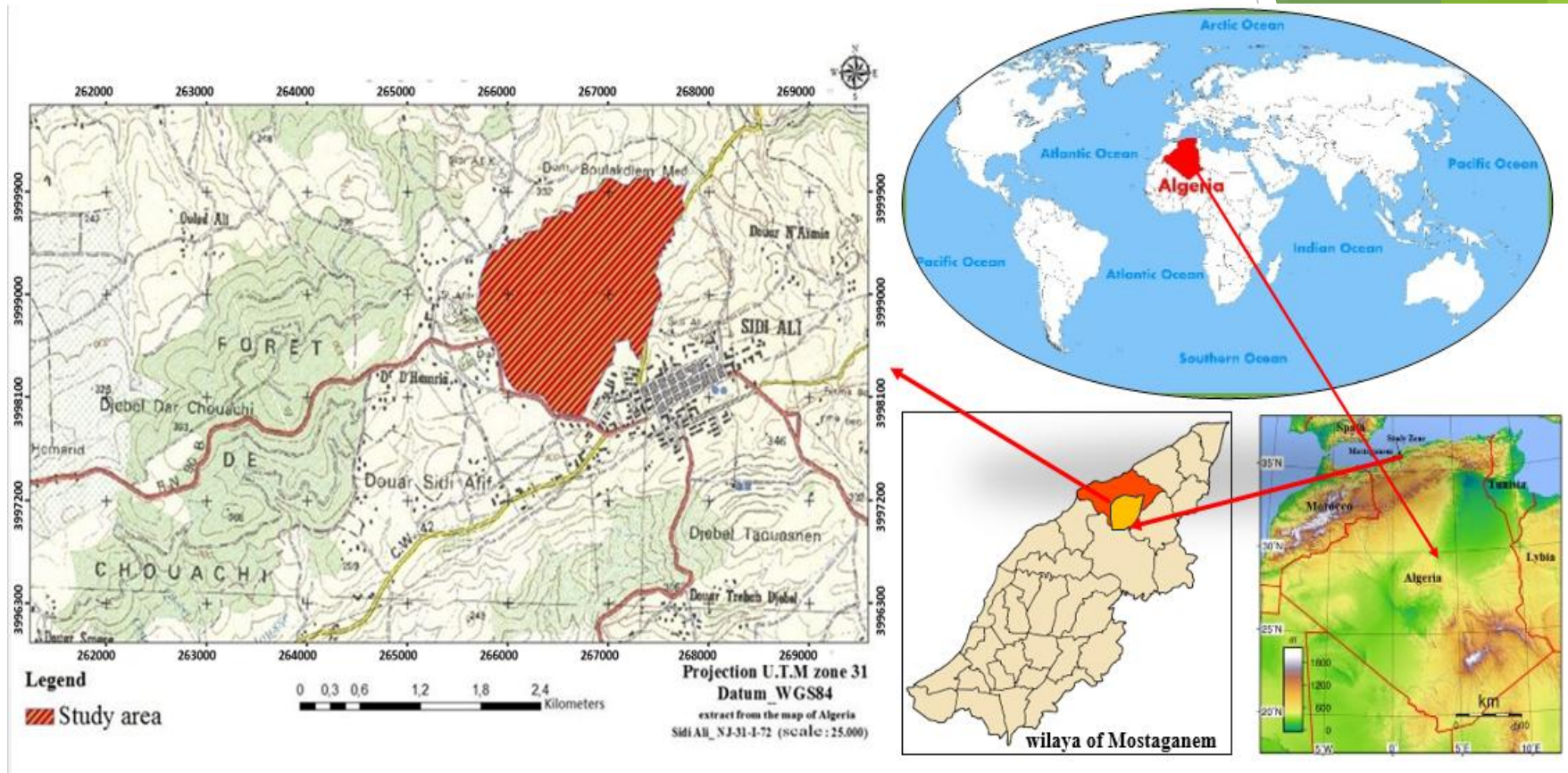
Mss. Hamadi Amina & Pr. Larid Mohamed



47 Km

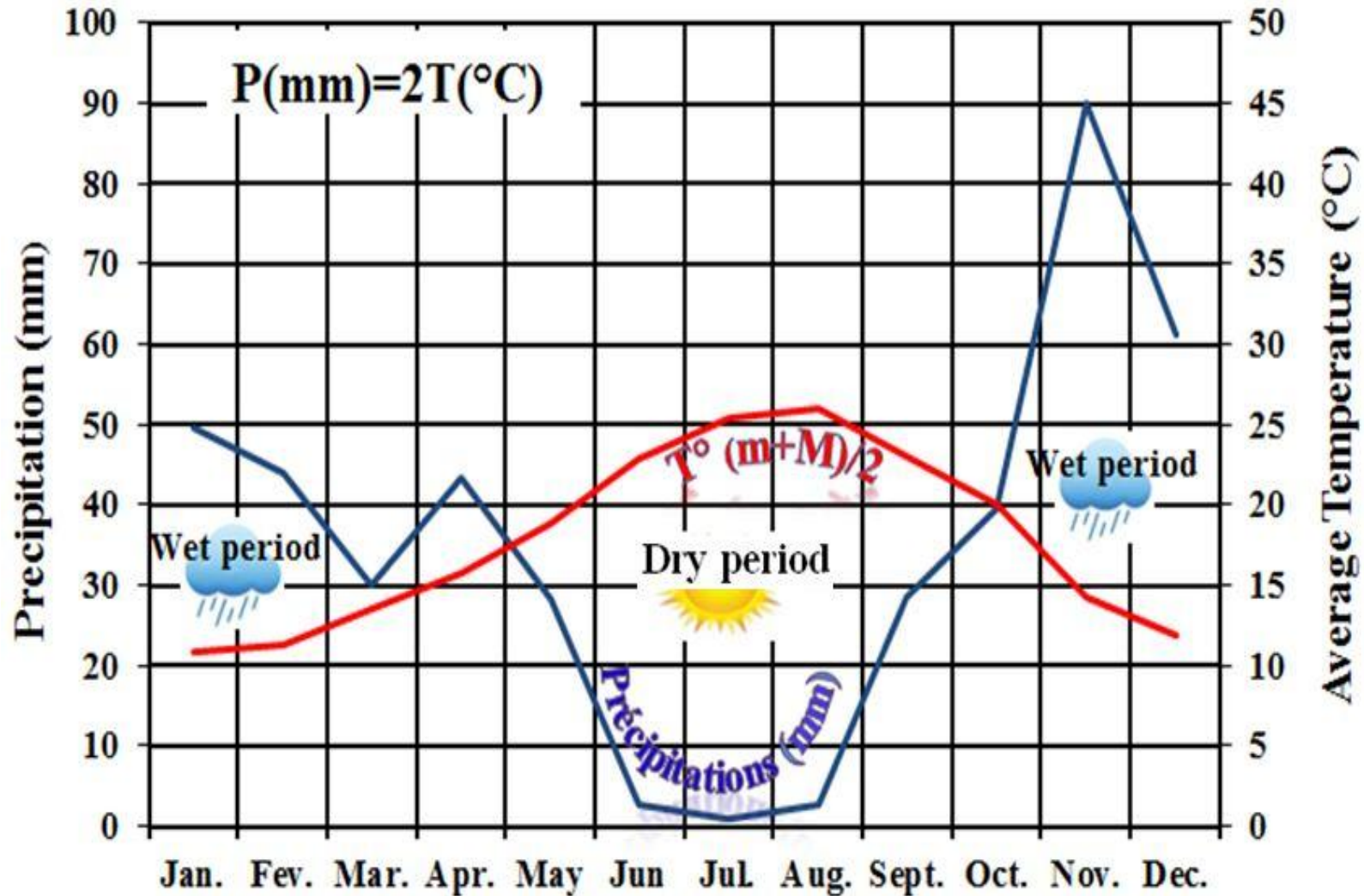


Geographical situation of the study area

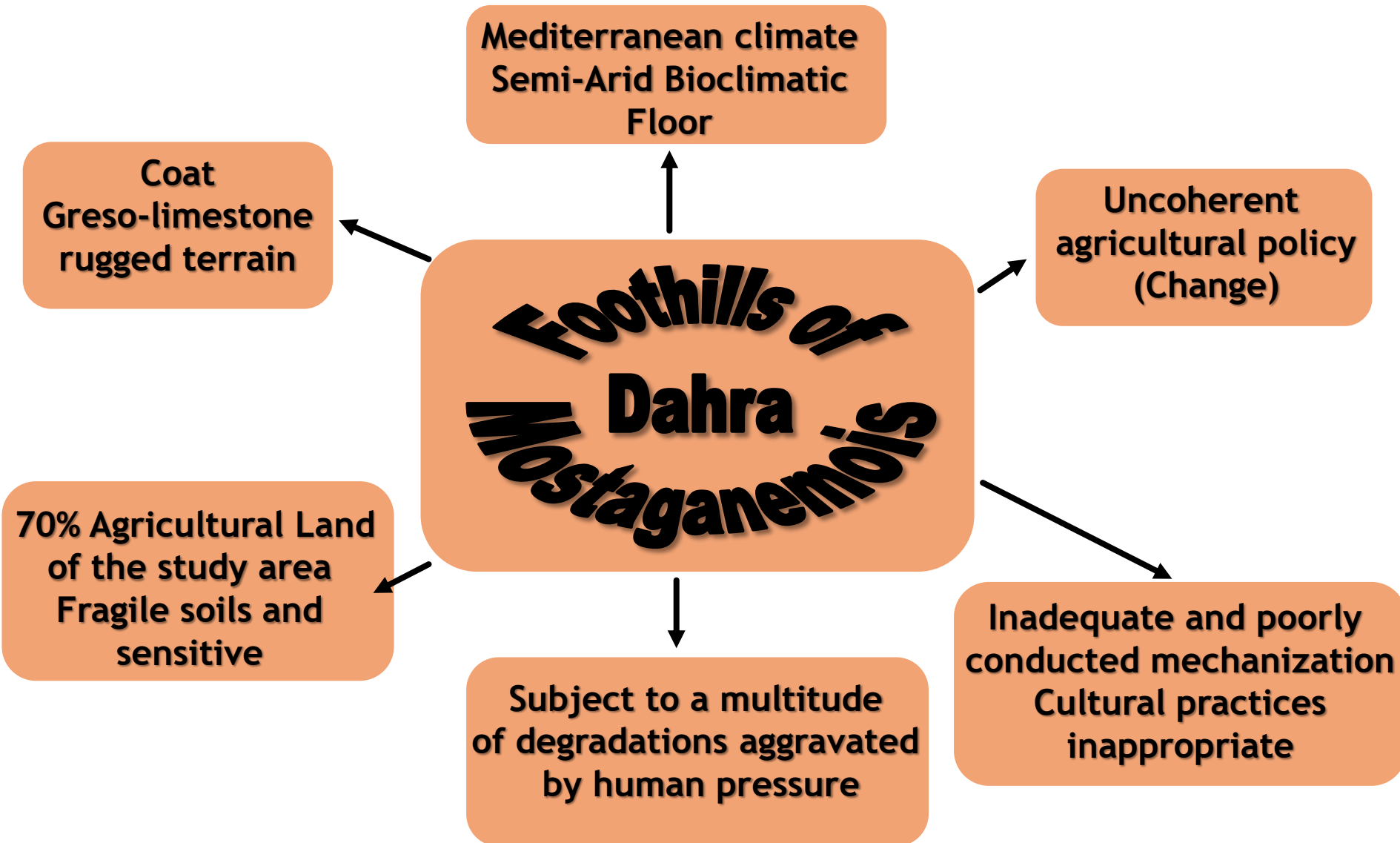


**The surface:
268ha**

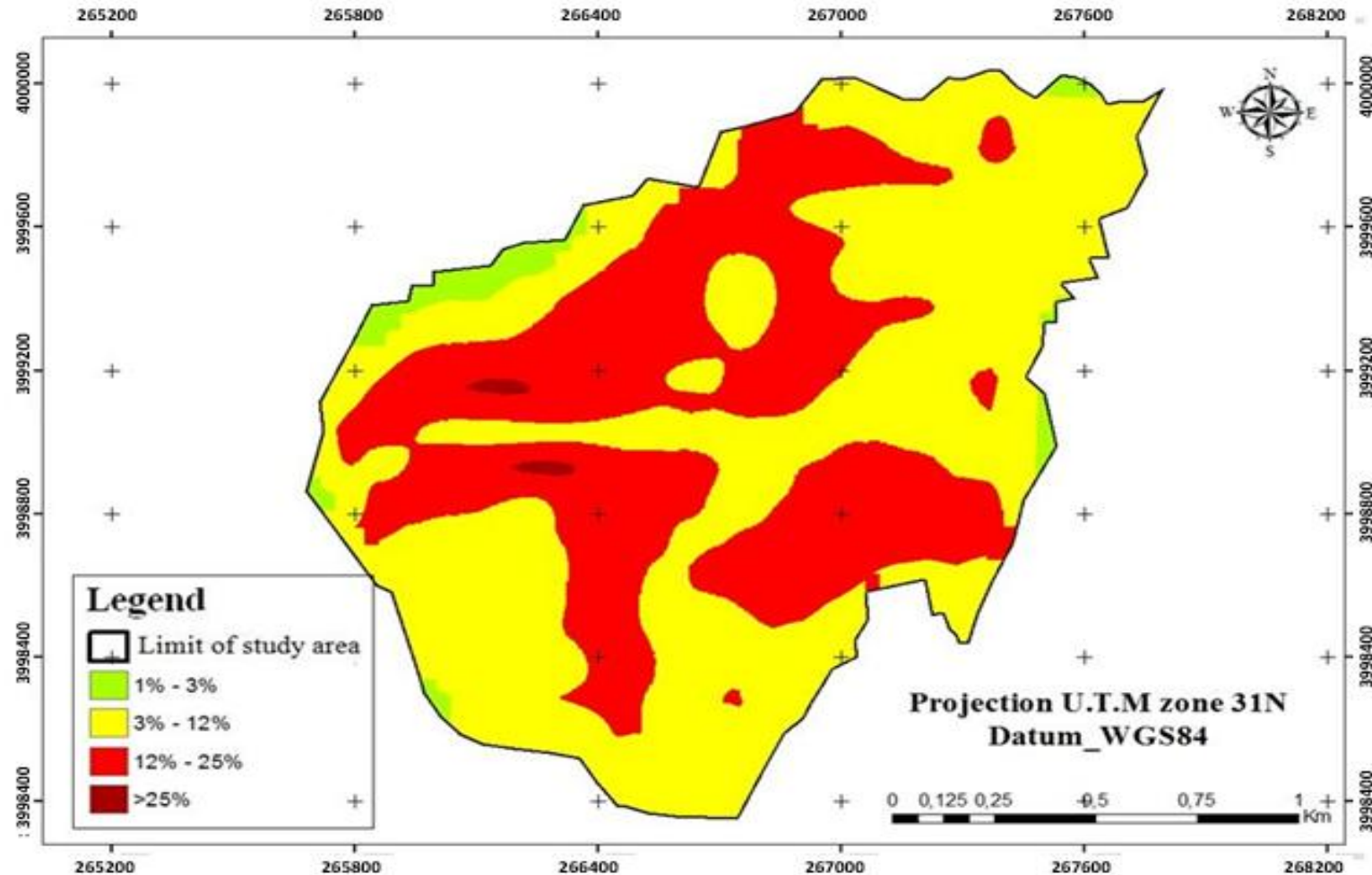
Climatic overview of the study area



Problem of the study area

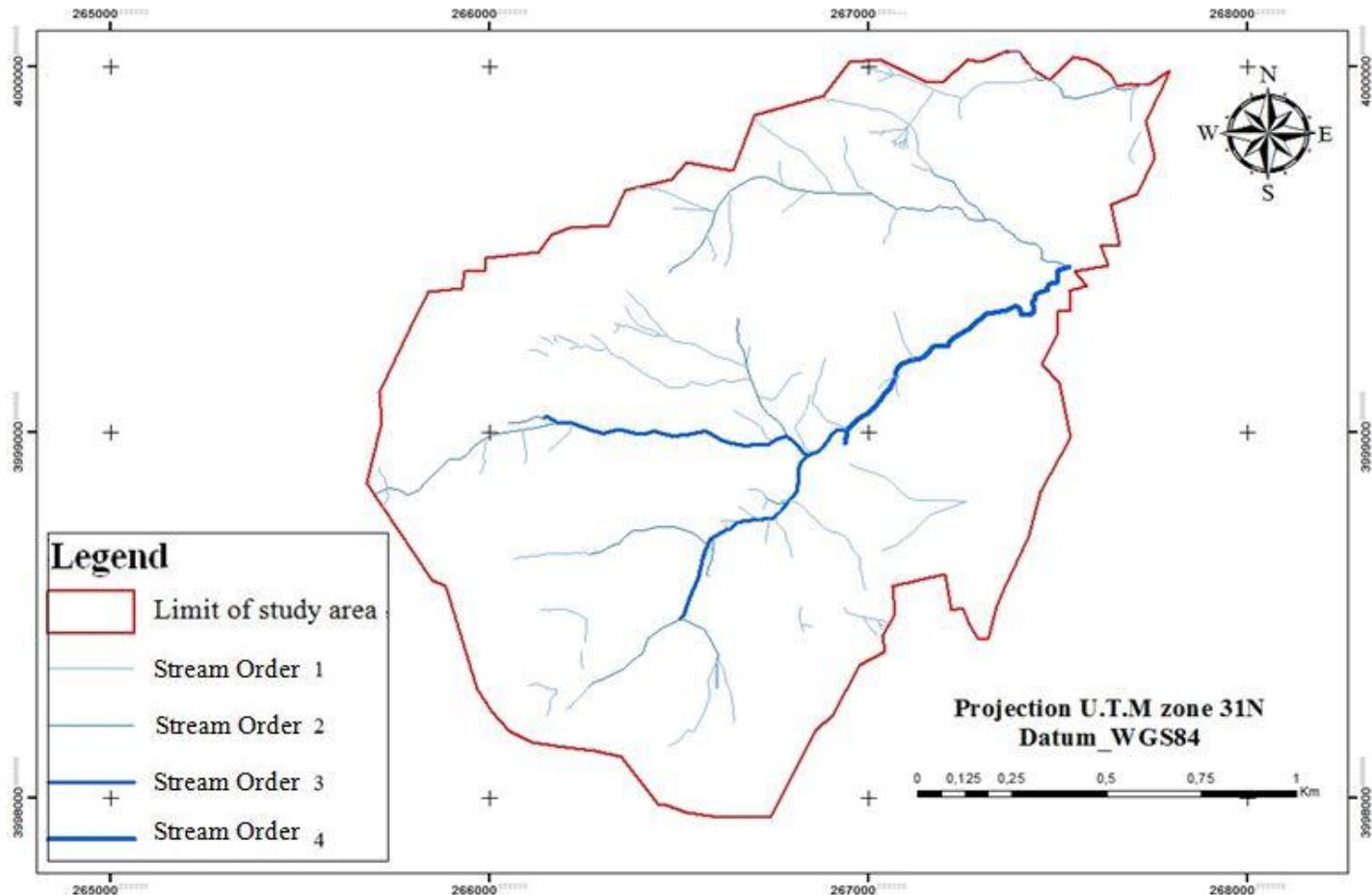


Physical environment of the study area



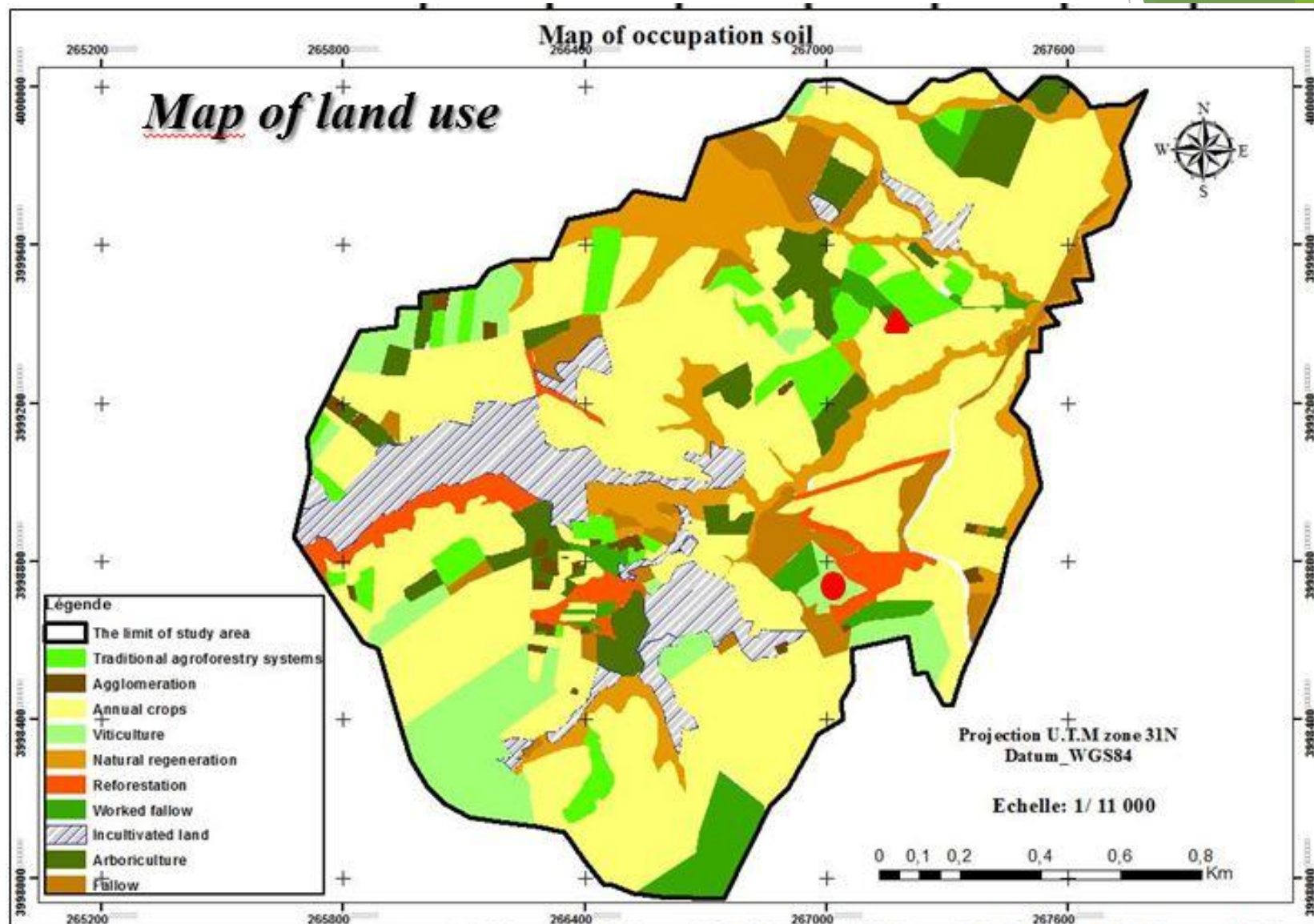
Map of slope

Physical environment of the study area



Map of stormwater systems

Physical environment of the study area



Experimental approach

Modes of management (agricultural production System)

↓
14 different plots (agricultural parcel)

↙
Land use

↘
Slope

Mixed farming (M):

04 plots belonging to agroforestry system (MF)

Agricultural cropping (A):

-04 plots with non-irrigated tree crop cultivation (AT1),

-04 plots with annual field cropping (AA),

-and 02 plots under fallow system cultivation (AA2).

Experimental approach

Sampling

The surface soil analysis is the most important compared to that of the subsoil.

At each plot, 03 samples were taken from the topsoil (0-30 cm) according to a strat-ified random sampling design along the slope.



Physicochemical analyzesh of samples

Parameters		Standards	n
Laboratory analysis			
Particle size distribution (%)		NF X31-107	3
Texture		-	3
pH(H ₂ O)	1:2.5 suspension in water	NF ISO 10390	3
pH(KCl)	1:2.5 suspension in water		3
EC (dS/m)	1:5	ISO 11265	3
Organic C (%)	Aschmann	NF ISO 10694	3
Total N (%)	Kjeldahl	ISO 13878	3
Extractable P (mg.kg ⁻¹)	Aschmann	NF ISO 11263	3
Exchangeable K ⁺ (cmol ⁺ .kg ⁻¹)	Ammonium acetate		3
Exchangeable Ca ⁺² (cmol ⁺ .kg ⁻¹)	Ammonium acetate		3
Exchangeable Na ⁺ (cmol ⁺ .kg ⁻¹)	Ammonium acetate	NF X31-108	3
Exchangeable Mg ⁺² (cmol ⁺ .kg ⁻¹)	Ammonium acetate		3
Total CaCO ₃ (%)	Bernard calcimeter	NF ISO 10693	3
Active CaCO ₃ (%)	Drouin	NF X 31-106	3
Parameters calculated from field data			
OM (%)	Calculation	-	3
C/N ratio	Calculation	-	3
Estimate CIC (cmol ⁺ .kg ⁻¹)	Calculation	-	3
	exchangeable cations (Ca ⁺² , Mg ⁺²)		

National Institute of Soil
Irrigation and Drainage
(Relizane)

Laboratory of Biodiversity, Soil
and Water Conservation,
University of Mostaganem,

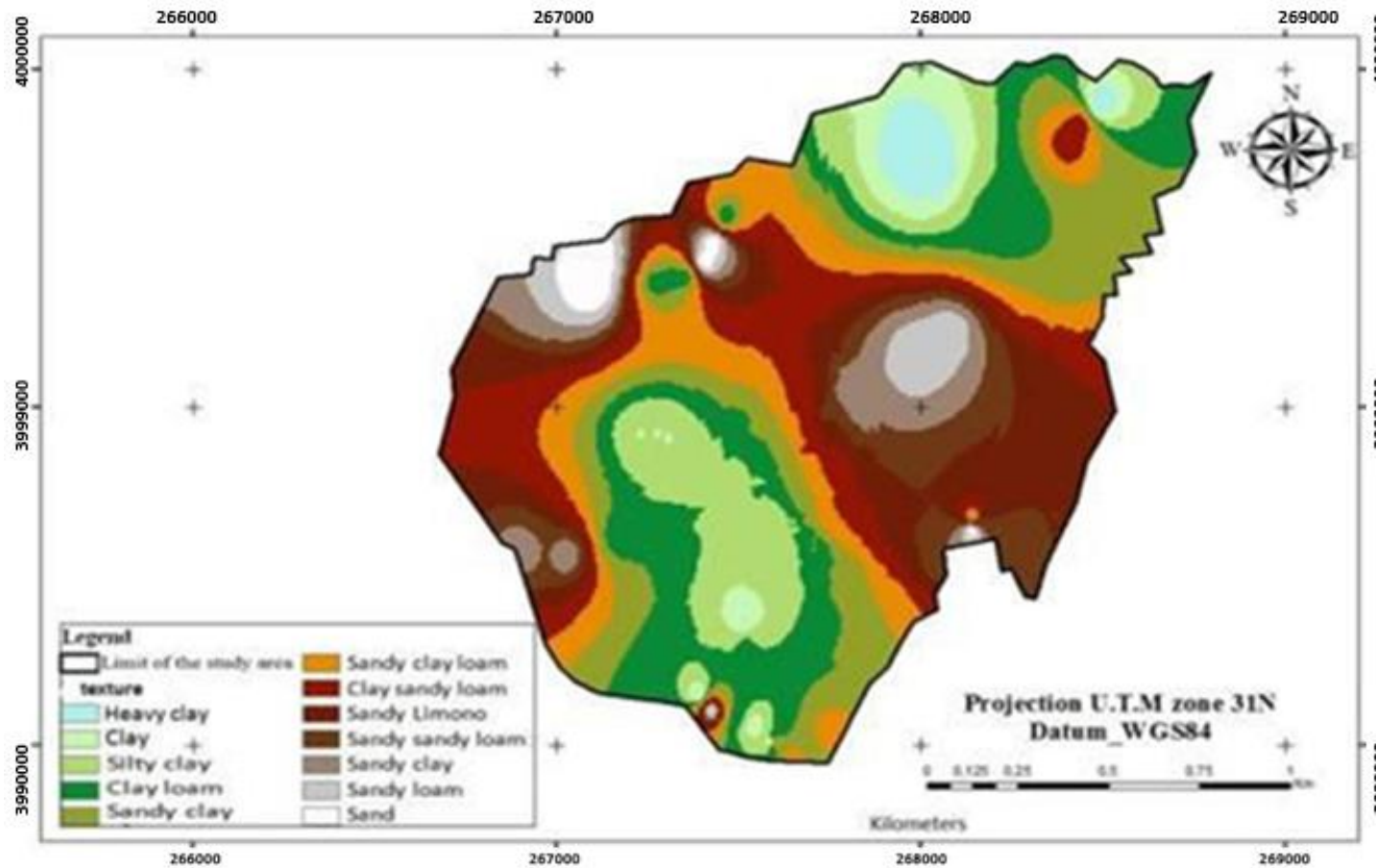
Soil Erosion Laboratory of
the Institute of Sustainable
Agriculture of CSIC
(Cordoba-Spain)

Statistical analyzez

A one-way analysis of variance (ANOVA) and The Student-Newman-Keuls test (SNK) of soil parameters of the different cropping systems were carried out to evaluate the relationship between the different cropping systems practiced in the study area and their soil fertility parameters.

This statistical method, widely used in agriculture (Bojnec et al., 2024 ; Zenda Za Begani et al., 2024 ; Narmilan et al., 2022 ; Abubakar et al. 2018 ; Diallo et al., 2018 ; Kozak et Piepho, 2018 ; Rezgui et al., 2014)

The granulometric results



Map of lithology

Results of physico-chemical analyses of soil samples

Factor	Management		Parameters					
			pH(H ₂ O)	pH(KCl)	EC (dS/m)	CaCO ₃ Total (%)	CaCO ₃ Active (%)	
Mixed farming	Agroforestry system soil	MF.S1	7,79 ± 0,09 b	7,58 ± 0,07 ab	0,250 ± 0,017 b	14,15 ± 1,37 ab	4,71 ± 0,69 c	
		MF.S2	7,1 ± 0,17 c	6,89 ± 0,19 c	0,207 ± 0,159 b	3,26 ± 1,07 d	0,17 ± 0,07 e	
		MF.S3	7,18 ± 0,27 c	6,79 ± 0,26 c	0,087 ± 0,012 b	2,41 ± 0,67 d	0,21 ± 0,07 e	
		MF.S4	7,86 ± 0,03 ab	7,62 ± 0,02 ab	0,240 ± 0,036 b	10,61 ± 5,00 ab	5,25 ± 0,33 bc	
Agricultural cropping	Non-irrigated tree crop cultivation soil	AT1.S1	7,90 ± 0,20 ab	7,64 ± 0,19 ab	2,040 ± 0,485 a	15,14 ± 0,65 a	6,75 ± 0,57 a	
		AT1.S2	7,91 ± 0,04 ab	7,72 ± 0,03 ab	0,170 ± 0,026 b	4,15 ± 1,68 d	1,13 ± 0,55 e	
		AT1.S3	7,99 ± 0,13 ab	7,72 ± 0,19 ab	0,217 ± 0,074 b	6,08 ± 0,89 cd	0,25 ± 0,12 e	
		AT1.S4	8,05 ± 0,01 ab	7,82 ± 0,02 a	0,247 ± 0,038 b	15,42 ± 0,89 a	6,42 ± 0,75 ab	
	Annual field cropping soil	AA.S1	8,20 ± 0,13 a	7,81 ± 0,23 a	0,247 ± 0,081 b	14,72 ± 1,49 a	6,38 ± 0,45 ab	
		AA.S2	8,17 ± 0,03 a	7,76 ± 0,02 ab	0,370 ± 0,295 b	15,28 ± 1,47 a	4,71 ± 0,63 c	
		AA.S3	8,15 ± 0,12 a	7,80 ± 0,12 ab	0,313 ± 0,179 b	13,87 ± 4,29 ab	5,38 ± 0,76 bc	
		AA.S4	8,16 ± 0,03 a	7,73 ± 0,13 ab	0,193 ± 0,040 b	9,62 ± 0,88 bc	2,88 ± 0,57 d	
	Fallow system cultivation soil	AA2.S1	7,94 ± 0,05 ab	7,42 ± 0,04 b	0,267 ± 0,057 b	16,27 ± 1,91 a	4,79 ± 0,89 c	
		AA2.S2	8,18 ± 0,03 a	7,75 ± 0,04 ab	0,167 ± 0,025 b	15,99 ± 1,61 a	6,21 ± 0,31 ab	
	ANOVA P-value			***	***	***	***	***

MF.S : Soil samples collected under agroforestry system ; AT1.S : Soil samples collected under non-irrigated tree crop cultivation ; AA.S : Soil samples collected under annual field cropping ; AA2.S : Soil samples collected under fallow system cultivation.

NS = Not significant; * = Significant ; ** = Highly significant; *** = Very highly significant at the probability level 5%, 1% and 1% respectively.

Different letters indicate significant differences using the Student-Newman-Keuls test, P value ≤ 0.05

Results of physico-chemical analyses of soil samples

Factor	Management		Parameters				
			Organic C (%)	Total N (%)	OM (%)	C/N ratio	Extractable P (mg.kg ⁻¹)
Mixed farming	Agroforestry system soil	MF.S1	1,00 ± 0,20 de	0,095 ± 0,010 bc	1,7 ± 0,3 cd	10,8 ± 1,9 c	2,17 ± 0,38 ab
		MF.S2	0,84 ± 0,09 e	0,035 ± 0,010 d	1,4 ± 0,2 d	25,9 ± 6,5 a	2,15 ± 1,51 ab
		MF.S3	0,78 ± 0,13 e	0,053 ± 0,011 cd	1,3 ± 0,2 d	13,8 ± 0,9 bc	2,80 ± 0,71 ab
		MF.S4	1,62 ± 0,20 abc	0,133 ± 0,021 b	2,8 ± 0,3 ab	12,3 ± 1,2 bc	4,13 ± 0,52 ab
Agricultural cropping	Non-irrigated tree crop cultivation soil	AT1.S1	0,98 ± 0,22 de	0,086 ± 0,026 bc	1,7 ± 0,4 cd	12,2 ± 2,8 bc	2,13 ± 0,61 ab
		AT1.S2	1,11 ± 0,16 de	0,060 ± 0,013 cd	1,9 ± 0,3 cd	20,3 ± 5,9 b	1,81 ± 0,27 b
		AT1.S3	1,25 ± 0,04 cde	0,081 ± 0,003 bc	2,2 ± 0,1 cd	15,6 ± 0,4 bc	4,01 ± 2,76 ab
		AT1.S4	1,97 ± 0,06 a	0,177 ± 0,019 a	3,4 ± 0,1 a	11,0 ± 1,1 c	6,83 ± 2,04 ab
	Annual field cropping soil	AA.S1	1,08 ± 0,29 de	0,082 ± 0,026 bc	1,5 ± 0,3 d	10,2 ± 1,0 c	8,37 ± 4,02 a
		AA.S2	1,17 ± 0,12 de	0,090 ± 0,005 bc	2,0 ± 0,2 cd	13,5 ± 0,7 bc	3,64 ± 0,42 ab
		AA.S3	1,21 ± 0,09 cde	0,104 ± 0,011 bc	2,1 ± 0,2 cd	11,7 ± 0,6 bc	4,92 ± 2,27 ab
		AA.S4	1,37 ± 0,34 bcd	0,114 ± 0,024 b	2,4 ± 0,6 bc	12,1 ± 0,3 bc	4,94 ± 1,59 ab
Fallow system cultivation soil	AA2.S1	1,72 ± 0,16 ab	0,120 ± 0,034 b	3,0 ± 0,3 ab	14,9 ± 2,9 bc	7,42 ± 4,88 ab	
	AA2.S2	1,95 ± 0,26 a	0,129 ± 0,028 b	3,4 ± 0,4 a	15,7 ± 5,3 bc	3,35 ± 0,45 ab	
ANOVA P-value			***	***	***	***	***

MF.S : Soil samples collected under agroforestry system ; AT1.S : Soil samples collected under non-irrigated tree crop cultivation ; AA.S : Soil samples collected under annual field cropping ; AA2.S : Soil samples collected under fallow system cultivation.

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Different letters indicate significant differences using the Student-Newman-Keuls test, P value ≤0.05

Results of physico-chemical analyses of soil samples

Factor	Management		Nutriments (cmol ⁺ .kg ⁻¹)				Estimate CIC (cmol ⁺ .kg ⁻¹)	
			Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺		
Mixed farming	Agroforestry system soil	MF.S1	32,68 ± 1,41 ab	2,46 ± 1,36 bc	0,92 ± 0,17 abc	0,19 ± 0,18 b	36,25 ± 2,65 bc	
		MF.S2	3,18 ± 0,29 d	0,37 ± 0,04 c	0,29 ± 0,11 c	0,04 ± 0,01 b	3,88 ± 0,32 e	
		MF.S3	7,43 ± 3,87 d	1,42 ± 1,26 bc	0,57 ± 0,24 bc	0,15 ± 0,14 b	9,57 ± 5,5 e	
		MF.S4	32,86 ± 5,43 ab	1,53 ± 0,42 bc	0,81 ± 0,34 abc	0,12 ± 0,03 b	35,33 ± 5,22 bc	
Agricultural cropping	Non-irrigated tree crop cultivation soil	AT1.S1	43,46 ± 4,05 a	4,52 ± 0,24 a	0,81 ± 0,05 abc	1,43 ± 0,82 a	50,22 ± 4,84 a	
		AT1.S2	27,09 ± 2,42 bc	0,77 ± 0,18 bc	0,50 ± 0,09 bc	0,06 ± 0,01 b	28,42 ± 2,53 cd	
		AT1.S3	21,32 ± 7,40 c	1,89 ± 0,32 bc	0,99 ± 0,09 ab	0,30 ± 0,07 b	24,5 ± 7,78 d	
		AT1.S4	38,87 ± 2,32 a	2,65 ± 0,37 b	0,91 ± 0,23 abc	0,14 ± 0,01 b	42,57 ± 0,51 ab	
	Annual field cropping soil	AA.S1	34,96 ± 0,30 ab	1,4 ± 0,50 bc	0,69 ± 0,23 bc	0,19 ± 0,12 b	37,24 ± 2,24 bc	
		AA.S2	39,97 ± 2,07 a	1,33 ± 0,21 bc	0,68 ± 0,05 bc	0,10 ± 0,01 b	42,08 ± 6,92 ab	
		AA.S3	38,08 ± 7,87 ab	2,13 ± 1,63 bc	0,71 ± 0,26 abc	0,58 ± 0,83 b	41,5 ± 6,92 ab	
		AA.S4	38,06 ± 4,46 ab	1,65 ± 0,56 bc	1,32 ± 0,58 a	0,15 ± 0,07 b	41,19 ± 5,16 ab	
	Fallow system cultivation soil	AA2.S1	36,54 ± 5,20 ab	1,95 ± 0,51 bc	0,45 ± 0,13 bc	0,23 ± 0,07 b	39,18 ± 5,23 abc	
		AA2.S2	41,95 ± 5,0 a	2,21 ± 0,65 bc	0,50 ± 0,11 bc	0,48 ± 0,53 b	45,13 ± 5,22 ab	
	ANOVA P-value			***	0.00016	0.00151	0.00592	***

MF.S : Soil samples collected under agroforestry system ; AT1.S : Soil samples collected under non-irrigated tree crop cultivation ; AA.S : Soil samples collected under annual field cropping ; AA2.S : Soil samples collected under fallow system cultivation.

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Conclusion

The degradation of agricultural soils is becoming a big worrying problem for agriculture in the foothills of Dahra Mostaganémois.

Soil fertility in this area is limited not only by the limited availability of water, but also by low organic matter contents which makes them vulnerable to its structural degradation by erosion

The statistical analysis of the physico-chemical quality of soils in this area suggests that agroforestry practices can enhance soil nutrient availability, likely due to the contribution of organic matter from trees, improved root structures, and reduced erosion.

The ability of this system to retain nutrients is vital for sustaining crop production and maintaining soil health.

Perspectives

- ❖ **Appropriate cropping techniques,**
- ❖ **Choice of local species for biological control combined with mechanical methods,**
- ❖ **Develop awareness among development agents.**

An aerial photograph of a landscape featuring a winding path or road through a mix of green vegetation and lighter, sandy or grassy areas. The text "Thank you for attention" is overlaid in the center in a bold, yellow font with a reflection effect below it.

Thank you for attention

THANKS TO THE RESEARCH TEAM:

Larid Mohamed, José Alfonso Gómez Calero



Time to questions



Please easy