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Functional profiles of soil microbial populations under various climatic conditions and agricultural practices in Burkina-Faso

S. Bourgerie [1], M. Motelica-Heino [2], B. Sajaloli [3], E. Yengué [4], D. Morabito [1]

[1] LBLGC, Université d'Orléans, France

[2] Institut des Sciences de la Terre d'Orléans (ISTO), UMR 7327 CNRS-Université d'Orléans, France

[3] CEDETE, Université d'Orléans, France

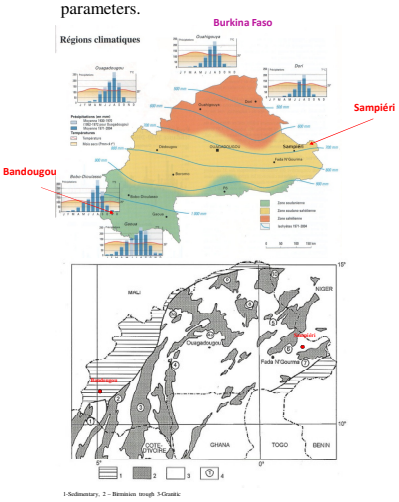
[3] CITERES, UMR 7324 CNRS-Université de Tours, France

Introduction

BIOSOL is a multidisciplinary scientific program (soil science, agronomy, geography) which aims at understanding and promoting agro-ecological practices among peasant communities in Burkina-Faso. In this work, the pedological, geochemical and microbiological characteristics of agricultural soils were investigated in order to make an inventory of soil fertility. Two sites (villages of Sampiéri and Bandougou) with contrasted pedo-climatic conditions were selected.

Material and methods

The microbial biomass and community level physiological profiles were determined by using the MicroResp™ system in topsoils. Surface soil samples (0-15 cm) were also evaluated for physico-chemical characteristics such as the organic carbon and nitrogen concentrations, exchangeable cations and pH together with their structure and texture and other soil physical parameters.



1-Sedimentary, 2 – Birrimien trough 3-Granitic

Sampiéri



Ferrogeneous soils
Sudano-sahelian climate
Milet-bean croppings

Bandougou



Ferralitic soils
Sudanese climate
Mais-bean croppings

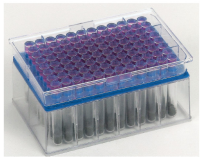
Pedological study

Sampling with a edelman auger
2 mm mesh sieving
LaMotte textural soil kit (code 1067)

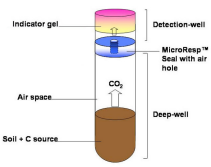
Physico-chemical study

pH: distilled water extracts (1:2.5 w/v) (NF ISO 10390)
Total organic carbon and total nitrogen: Flash pyroliser
Exchangeable cations: LaMotte universal extraction solution (S/L 1/10) and ionic chromatography (Dionex ICS-2000, Sunnyvale, CA)

Microbial study



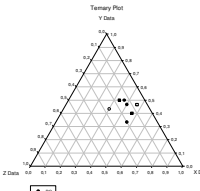
Assembled MicroResp™ system



Schematic diagram of a deep well connected to a detection well

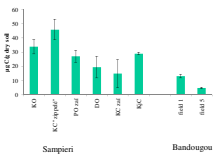
Results

Sampiéri

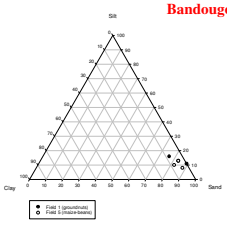


	KO	KC zippelé	KC zaï	DO	PO zaï	KjC
pH	7,3	6,6	6,6	6,7	6,7	7,5
C mg/g soil	11,7	5,36	12,2	10	6,5	7,1
N mg/g soil	3,3	2,8	3,4	3	3,5	3,1
C/N	3,5	1,9	3,6	3,3	1,9	2,3
Mg++ exch. (cmol/kg)	6,67	7,94	10,71	7,54	4,75	4,18
K+ exch. (cmol/kg)	4,38	3,60	5,51	7,00	4,03	20,17
Ca++ exch. (cmol/kg)	41,19	23,91	42,22	25,79	20,99	22,23

Microbial biomass



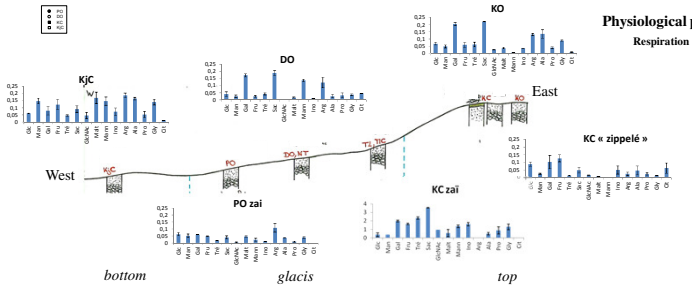
Bandougou



	Field 1	Field 5
pH	6	6,1
C mg/g soil	4,7	8
N mg/g soil	0,8	1,1
C/N	6	8
Na+ exch. (cmol/kg)	0,19	0,45
Mg++ exch. (cmol/kg)	0,04	0,27
K+ exch. (cmol/kg)	0,03	0,21
Ca++ exch. (cmol/kg)	1,34	6,32

Physiological profiling of the soil microbial community

Respiration rates (mean µg C-CO_2 .g^{-1}.h^{-1} ± std. err.)



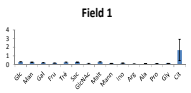
Metabolic quotient (qCO_2)

Sites	Samples	Metabolic quotient (qCO_2)
Sampiéri	KO	0.09
	KC « zippelé »	0.07
	KC zaï	0.32
	DO	0.18
	PO zaï	0.13
	KjC	0.12
Bandougou	Field 1	0.22
	Field 5	0.53

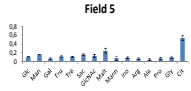
Catabolic evenness

SITES	Samples	Catabolic evenness (E)
Sampiéri	KO	0.88
	KC « zippelé »	0.88
	KC zaï	0.87
	DO	0.84
	PO zaï	0.84
	KjC	0.95
Bandougou	Field 1	0.83
	Field 5	0.91

Field 1



Field 5



Conclusion

Results indicate that the microbial biomass for all samples are low. Metabolic quotients (qCO_2) are very different and compared to samples from Sampiéri, statistically higher for samples from Bandougou, reflecting disturbed soils for these latter. Catabolic evenness were quite similar for all the samples. The soil ecosystem from Bandougou has significantly influenced the functions of soil microbial community and hence probably its composition. More generally, catabolic diversity of soil microbial community is variable under contrasted climatic and the influence of various cultural practices. This may indicate that the efficiency of soil quality restoration is under the control of many factors which could be further investigated such as the position on the slope along the topo-sequence, the composition of soils and particularly the availability of nutrients and the various cultural practices.

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