Urban soil carbon stability in semi-arid region: case study of Marrakech city

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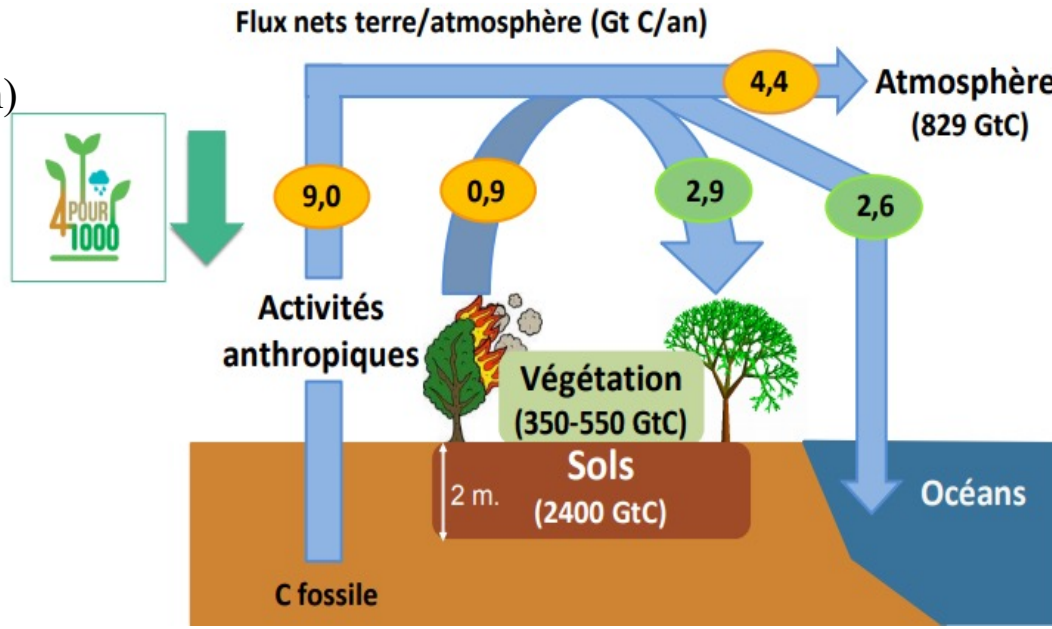
1. Introduction

GLOBAL CYCLE OF ORGANIC CARBON

- Soil is one of the largest pools of organic carbon (OC) (1462–1584 Pg in the top 100 cm)
- OC content is three times more than that of atmospheric or terrestrial vegetation pools (Schmidt et al., 2011)
- Small variation in soil C stock can have significant effect on atmospheric C concentration.

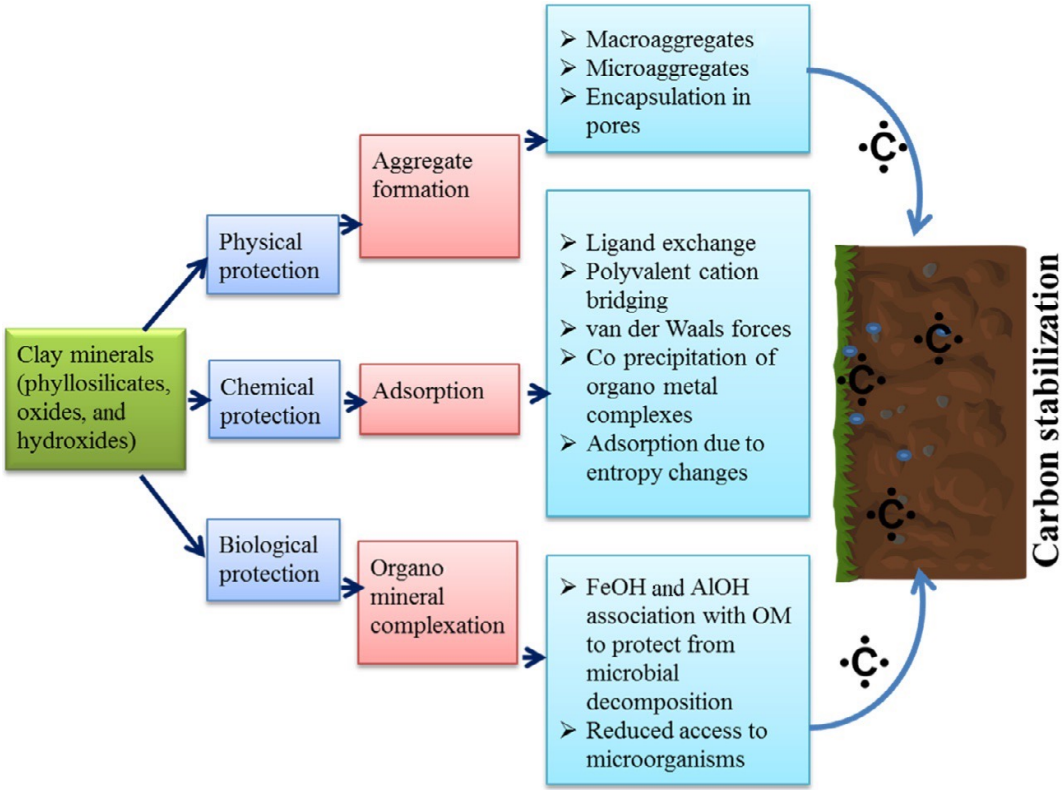


Ciais et al. 2014; Houghton 2007; Le Quéré et al. 2015

1. Introduction

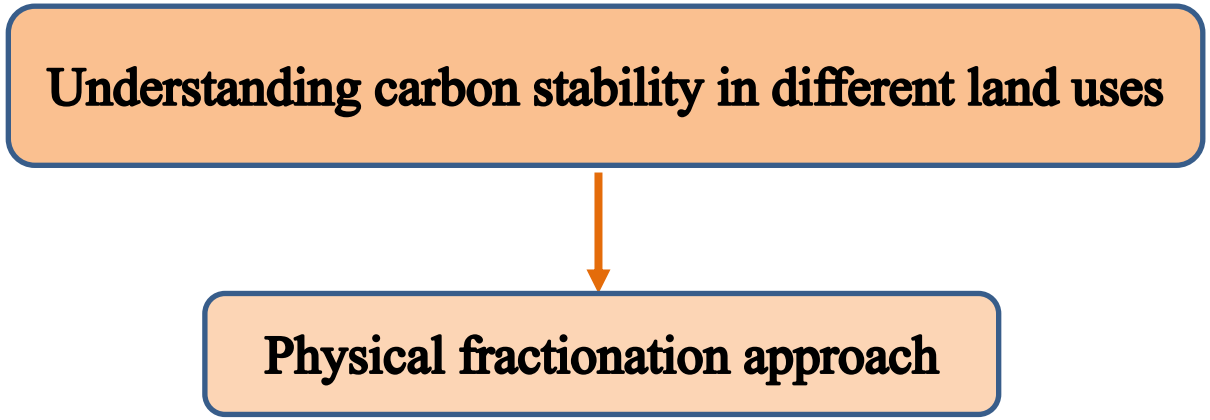
SOIL CARBON STABILIZATION

- Carbon stabily: Action which slows down the decomposition of SOM by reducing the mineralization rate.
- Three main mechanisms of C stabilization: physical, chemical, and biological.



Singh et al. 2017

2. Objectif


Understanding carbon stability in different land uses
Physical fractionation approach

3. Materials and Methods

Photos taken by BEROIGUI

Suburban agricultural soil irrigated with treated wastewater (SAS-TWW)

Suburban agricultural soil irrigated with water well (SAS-WWE)

Suburban agricultural soil irrigated with wastewater (SAS-WW)

Control (C)

Landfill (LF)

Public Green Space (PGS)

Former Industrial Area (FIA)

Residential Area (RA)

7 land uses + control

26 sampling points

Over 0-30cm

→

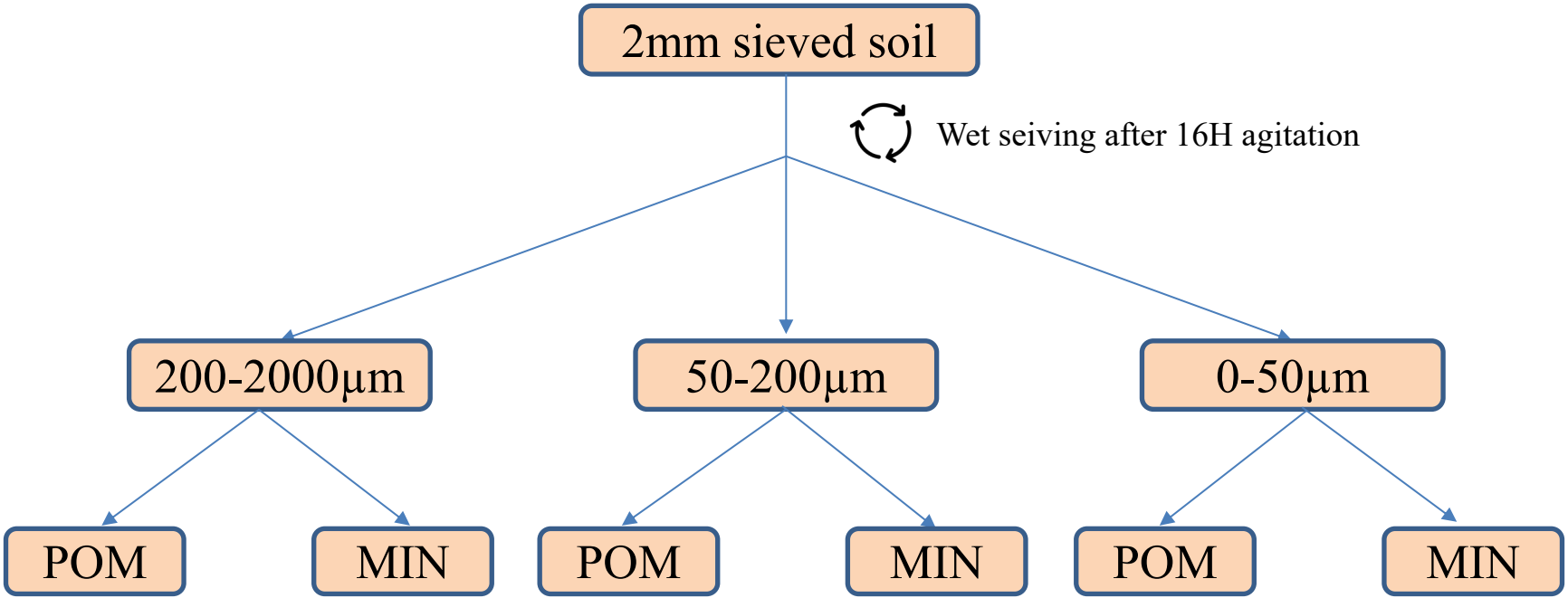
Particle size fraction

→

Carbon and Nitrogen analysis

3. Materials and Methods

PHYSICAL FRACTIONATION SCHEME (*Six et al. 2002*)

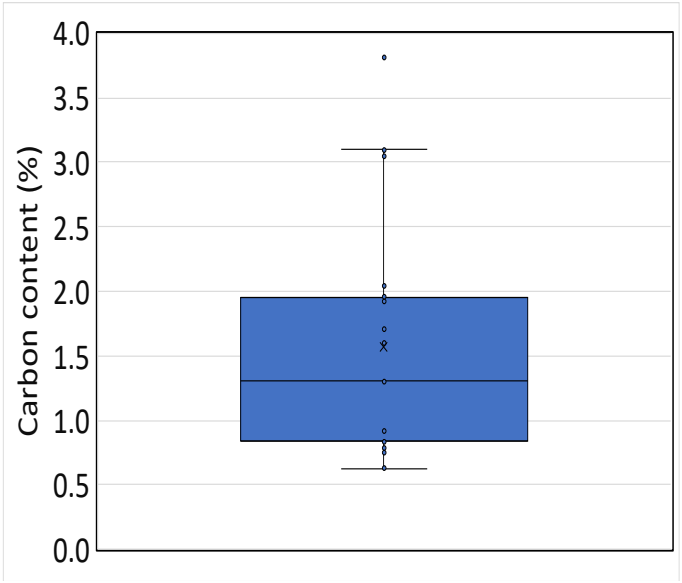


POM: Particulate Organic Matter fraction
MIN: Mineral fraction

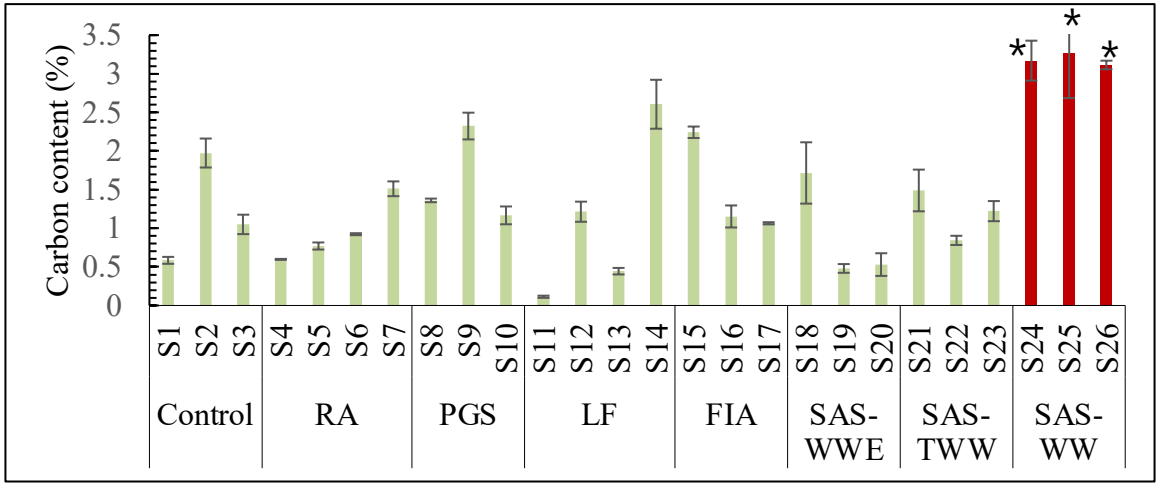
4. Results and discussion

SOIL CARBON CONTENT IN URBAN SOILS UNDER DIFFERENT LAND USES IN A SEMI-ARID REGION

- Average is 1.6%, while the median is 1.4%
- Lowest carbon content 0.1%
- Highest carbon content is 3.8%



- The values varied between 0.91% and 3.16%.
- SAS-WW use type which had a SOC content 3 times higher than the control soils

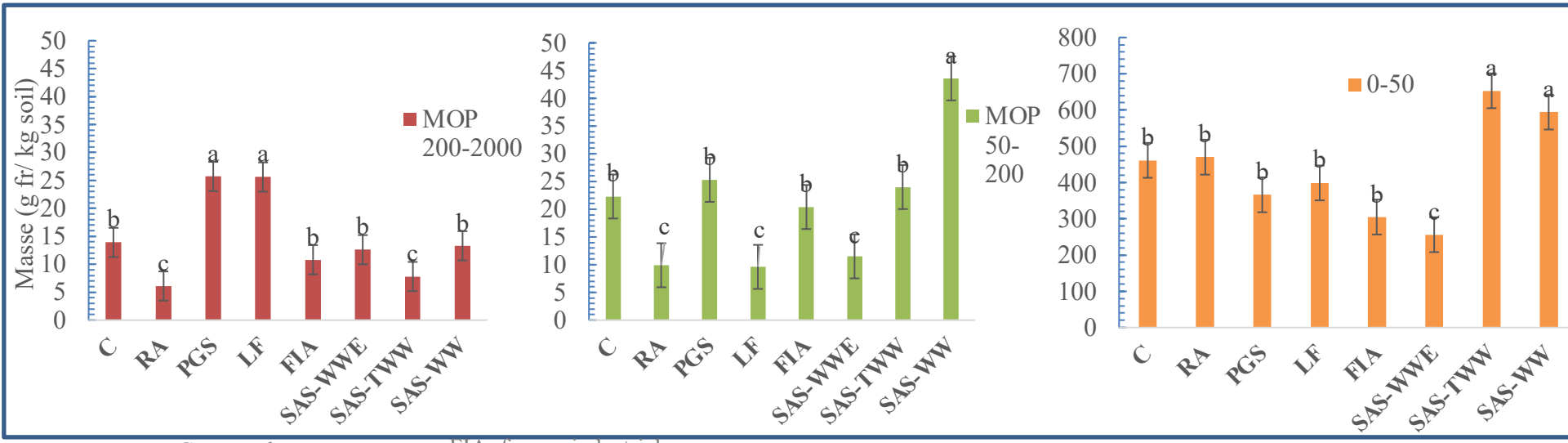


RA: residential area
PGS: public green space
LF: landfill
FIA: former industrial area
SAS-WW: suburban agricultural soil irrigated with wastewater

SAS-WWE: suburban agricultural soil irrigated with well water
SAS-TWW: suburban agricultural soil irrigated with treated wastewater

4. Results and discussion

FRACTION MASSE CONTENT IN URBAN SOILS UNDER DIFFERENT LAND USES



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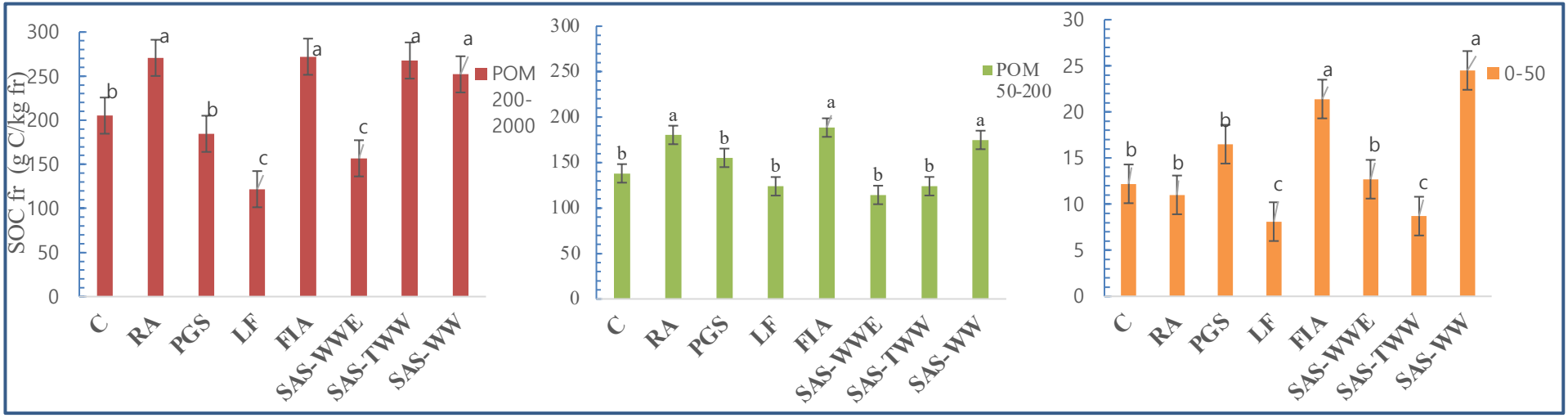
- Average masse content is 25g fr/kg soil for POM 200-2000 and POM 50-200.
- Fine fraction (0-50) showed 15 to 20 times higher masse content than both POM 200-2000 and MOP 50-200 in studied land uses.
- To be compared to *Grandière et al. 2008,* same trend was observed for No-till system under subtropical soil.

SOIL ORGANIC CARBON CONTENT IN FRACTIONS



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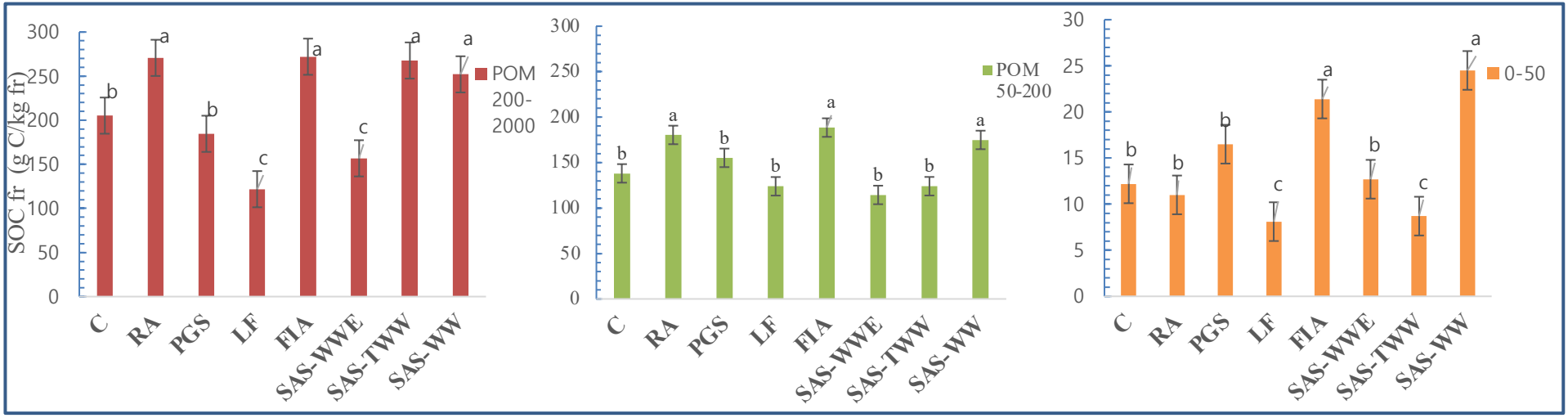
-Higher SOC recorded in POM 200-2000 µm and POM 50-200 µm than the fine fractions.
-Higher SOC for POM 200-2000 recorded for SAS-WW, SAS-TWW, FIA and RA (262, 267 and270 gC/g) comparatively to the control (205.2 gC/kg).
-Higher SOC for POM 50-200 recorded for SAS-WW, FIA and RA (188,174,180 gC/kg) comparatively to the control (138 C/kg).
-Average is 15 gC/kg in fine fractions (0-50 µm)
-Higher SOC for fine fraction was recorded at SAS-WW (25 gC/kg) than the control (12.2 gC/kg), but very low SOC compared to POM factions.

SOIL ORGANIC CARBON CONTENT IN FRACTIONS



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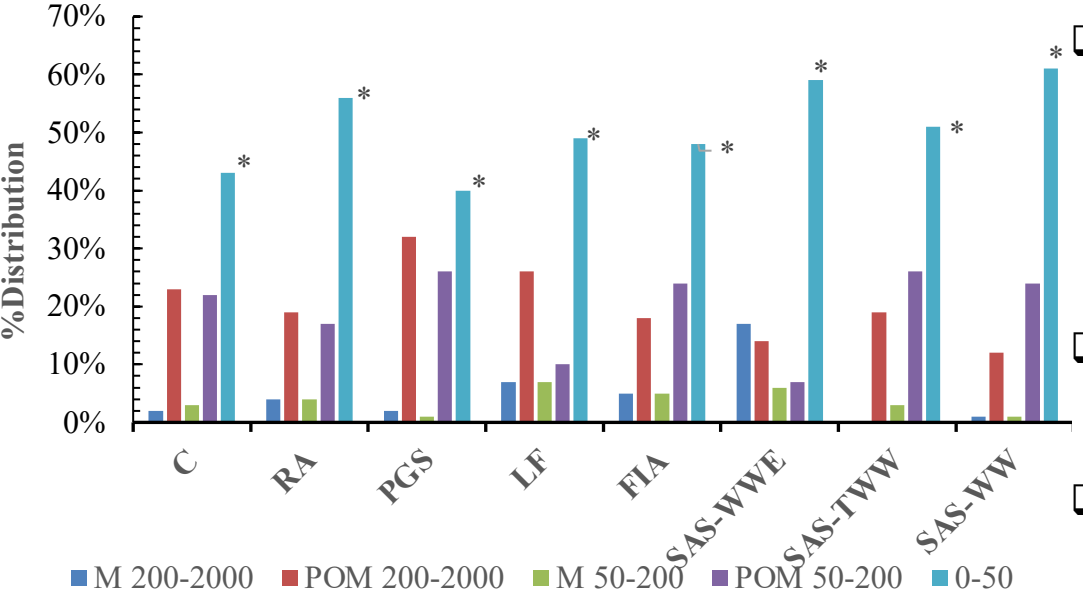
-To be compared to *Christensen, 1992* and *Feller, 1995* in temperate and tropical soils; our finding results recorded lower SOC in all studied fractions.

-SOC in fine fraction is protected by adsorption to mineral surfaces and by occlusion: they are then less accessible to microbial communities (Chenu & Plante, 2006)

4. Results and discussion

DISTRIBUTION OF CARBON UNDER DIFFERENT LAND USES IN A SEMI-ARID REGION



- % Carbon distribution reached a maximum of 60% for both suburban agricultural soils irrigated by well water and wastewater compared to the control (43%).
- Higher % Carbon distribution in fine fractio n in all studied land uses compared to POM
- Charenbroch et al. (2005) had reported 79% carbon distribution in Moscow urban park in (Idaho, USA), while 55% was outlined in maintained green space in upper 44cm (*Cambou et al. 2018*).

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Conclusion

- SOC stability is influenced by land use, soil type, and climate.
- Suburban area irrigated with wastewater showed significant carbon content.
- Regardless of soil type and land use, fine fraction is less enriched with OC compared to POM fraction, even though its carbon distribution is higher.
- The fine fraction in association with OC serve as components for the construction of microaggregates.
- The fine fraction could represent a stable fraction due to the strong binding with mineral soil particles.

Thank you for your attention

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