

Various climate challenges such as extrem heat waves and flooding create a destructive feed back loops in urban environments and in agricultural areas.

Research innovative approches: Leonardite and the rain tree or "l'arbre de pluie".

In these studies we are testing the leonardite as a promizing biostimulant and an adsorbent to improve soil properties and waste water quality.

Simultaneously, we are studying the impact of the rain tree in urban area to promote rain water infiltration, soil stability and water sources preservation.

Urban management

The rain tree is an urban management to mitigate the strain on sewage system. This strategy was successfully introduced in a french city of Lyon (Office Français de la biodiversité, 2022) to manage rainwater where it falls and reduce the volume of rain water runoff entering the sewage system, while simultaneously promoting biodiversity and improving soil health.



Leonardite

Leonardite is the organic matter that has the higher degree of oxidation in the coalification process. The result of a humification that lasted up to 70 million years.

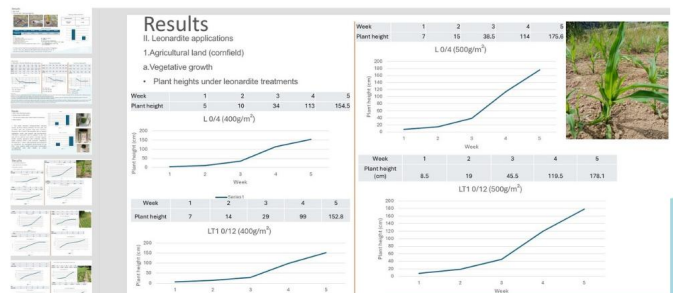
This natural material is not a fertilizer, but a soil conditioner, biocatalyst and biostimulant for plants (humintech.de). Furthermore, it is long term effect because it is degraded more slowly than for example compost, because it contains more organic matter that is also more resistant to composers (humintech.de). It is, therefore, by nature the most sustainable and efficient raw material that can improve soil quality

Methodology

II. Rain Tree

In this research studies, I will evaluate the performance and the impact of the rain tree management in urban area, after the implementation of the infiltration trench by assessing the following measurements:

1. Management : Infiltration trench implementation
2. Assessments : Performance evaluation before leonardite application
- ✓ Soil Permeability: using porchet test and this formula:
→ Formula: $K = 1000 \times V \times S \times t$
- ✓ Infiltration capacity + total infiltration by Horton's infiltration method (Yashwanth, 2019), using these formulas:
→ Formulas : $f_p = f_c + (f_0 - f_c) \times e^{-kx}$; $F = f_c \times t + [(f_0 - f_c) / k] \times [1 - e^{-k \times t}]$; $k = -[\ln(f_p - f_c) / (f_0 - f_c)] / (t_0 - t_1)$
(f_0 = infiltration capacity, t_0 = final capacity, F = total capacity and k = a constant representing the rate of decrease of f_p)
- ✓ RWC : Relative Water Content → Fresh, dry and turgid of the rain tree leaves (Galati & CLEMENT-VIDAL Anne CIRAD/BIOSUPR 104-ANVA, 2023)
→ Formulas : $RWC \% = (WF - WD) \times 100 \div (WT - WD)$ → RWC ≥ 80 % (WF = fresh weight, WD = dry weight and WT = turgid weight)
- ✓ Carbone dioxide (CO₂) in the tree (Tocchi & Department of Forestry Wildlife Technology, Federal University Owerri, Nigeria, 2018), using this method:
→ Dry weight = $0.0613 \text{ DBH}^{2.7128}$ Where : DBH = Diameter at breast heigh (Lisboa SN, Et al., 2018)
→ Dry weight × 50 %
→ CO₂ = C × 3.6663 where C = weight of carbon in the tree
- ✓ Carbone dioxide in the soil using the flow throw chamber method (Franzuebbers & USD Agricultural Service, 2021) or estimating it using the stable fraction of the organic matter in the soil and this formula:
→ CO₂ = (final Corg - initial Corg) × 3.6663, where: Initial Corg: Corg in the beginning of the season, final Corg: Corg in the end of it and 3.6663: the weight of C (carbon) in CO₂



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