ID: 5042

Optimizing Food Production Through Strategically Integrating Biofertilizers in Soil Systems

Farch Sabrina[1*], Benlakehal Fatma Zahra[2] and ghardaoui Dahbiya[2]

[1]Head of Biomaterials and Transport Phenomena Laboratory, university pole, block 5, Medea, 26000, Algeria.

[2]Faculty of Sciences. Dr. Yahia Fares University of Medea "Campus Ouzera" 26000. Algeria

*Corresponding author's email: farch.sabrina@univ-medea.dz ; farchs@yahoo.fr

ABSTRACT

This study addresses the challenges posed by the low fertility of Algerian soils and the prohibitive costs of chemical fertilizers, prompting farmers to explore alternative and sustainable fertilization approaches. The research focuses on the soil of the Mendas Lawhat Group Division in Sidi Naamane, Medea province "Algeria". The findings reveal that the soil predominantly consists of sand, constituting 72.88% of its composition, followed by silt at 24.49% and clay at 2.165%. The introduction of biofertilizer materials results in significant variations in soil elements and ions. For example, the application of compost increases bicarbonate ion concentrations to 1220 mg/L, while poultry manure leads to an even higher concentration of 3050 mg/L. Biological fertilizers also impact the soil's electrical conductivity, showing a substantial increase from 0.92 ms/Cm to 31.9 ms/Cm after applying poultry manure. Furthermore, the use of compost and poultry manure leads to an elevation in chloride concentrations, ranging from 35.5 mg/L to 390.5 mg/L within 7 days. These shifts in element and ion concentrations underscore the influence of biofertilizer materials on the soil's chemical composition, indicating their potential to enhance soil fertility by augmenting nutrient availability for plant growth. In conclusion, the utilization of biofertilizer materials presents a sustainable alternative to enhance soil quality and boost agricultural yields. Effective management and regular monitoring of the soil's physicochemical parameters are crucial for the success of these environmentally-friendly practices, contributing to the advancement of the agricultural sector in Algeria while safeguarding soil health and the ecosystem.

Keywords: Biofertilizer materials, soil, nutrient availability and agricultural development in Algeria

1 Introduction

The soil, a precious asset essential to agriculture and life on Earth, is threatened by intensive farming practices, increasing urbanization, and environmental degradation. The wilaya of Medea, due to its geographical location and agricultural significance, is facing soil degradation, thereby limiting its productivity. To address this challenge, sustainable approaches such as the use of fertilizing biomaterials are emerging. These natural substances, derived from organic waste or the agro-food industry, offer an environmentally friendly solution to maintain soil productivity. The objective of this study focuses on the use of various biomaterials such as compost, chicken manure, cow dung, and sheep manure, highlighting their potential benefits for improving food production sustainably.

2 Experimental

The experimentation took place in the municipality of **Sidi Naemane** (Figure 1), located in the Médea province of Algeria. It is part of the administrative subdivision of Sidi Naemane, which is within the Northern region of Algeria. The municipality covers an area of 410 km² and has a population of 39.727 inhabitants, resulting in a population density of 97.0 inhabitants per km² in the Sidi Naàmane administrative division. Geographically, the municipality lies in the central Tell region, situated between the Blidean Atlas and the plains of Beni Slimene. It is approximately 100 km south of Algiers, 48 km southeast of Médéa, about 32 km east of Berrouaghia, 72 km southeast of Blida, 115 km east of Aïn Defla, and 79 km west of Bouira.

DOI: 10.21467/abstracts.170 ISBN: 978-81-970666-1-0 (eBook)

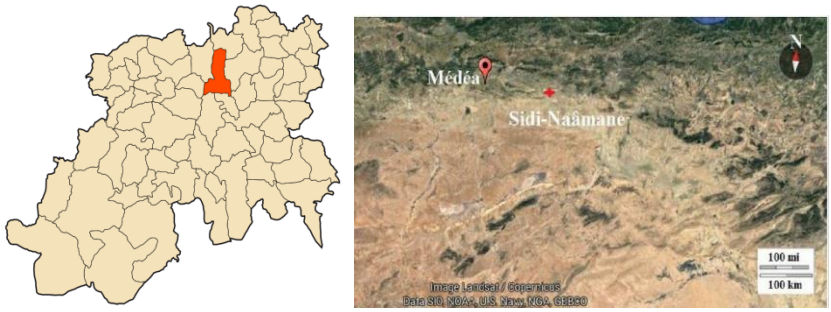

Figure 1: "Map of the geographical location of the study area (Sidi Naamane)"

The experimental trials followed three main steps: the preparation of a soil and organic matter mixture according to the specifications of the experimental plan, precise monitoring of parameters and doses in accordance with the plan to ensure consistency and reproducibility, and finally, the preparation of samples respecting the various combinations of doses and organic materials as planned. Each sample was meticulously labeled and identified to ensure proper traceability. The soil samples collected were subjected to analyses to evaluate several physico-chemical parameters in the figure 2.

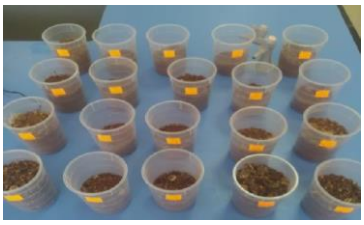

Figure2. "Preparation of the soil + Fertilizing Biomaterials mixture"

3 Results and Discussion

The results and discussions are essential to present the analyses of soil samples, focusing on the physico-chemical changes resulting from the application of fertilizing biomaterials.

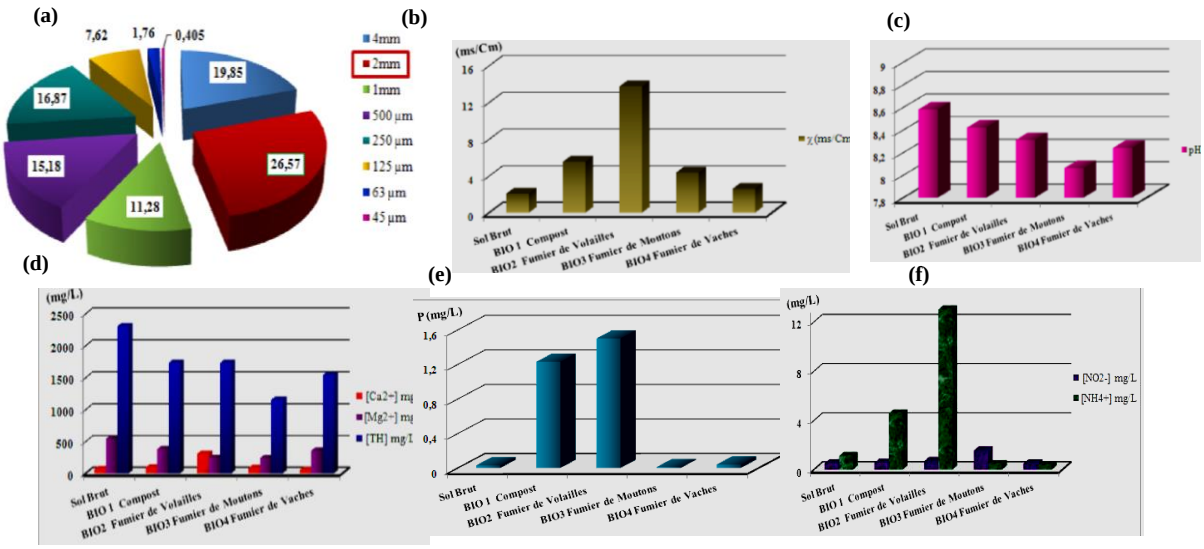

Figure 3:. (a) Particle size distribution in % in 1 kg of sieved soil
Figure 4:. (b-f) Analysis results after 2 months of evolution of the physico-chemical characteristics of the soil with various fertilizing biomaterials

ISBN: 978-81-970666-1-0
Series: AIJR Abstracts
DOI: 10.21467/abstracts.170

The percentages represent the proportions of each diameter in the 1 kg soil sample, with the 2 mm diameter dominating at 26.57%, indicating a significant presence of coarse gravel particles. This critical size can influence the physical properties of the soil, promoting the formation of macro-aggregates, improving air and water circulation, as well as nutrient availability for plants. The use of organic fertilizers led to changes in the concentrations of elements and ions in the soil, with specific variations depending on the type of fertilizer used. These results suggest a potential improvement in soil fertility and increased availability of certain nutrients for plants.

4 Conclusions

This work explores the use of fertilizing biomaterials to valorize organic waste and enhance food production. The study, conducted at the University Dr. Yahia Farès of Medea, analyzes the evolution of the physico-chemical parameters of the soil in Sidi Naamane, Medea, over a period of two and a half months in 2023. The results demonstrate notable variations in the soil's particle size distribution, mass loss due to evaporation, electrical conductivity, and ion concentration following the application of various organic fertilizers. These findings suggest a potential improvement in soil fertility and increased availability of certain nutrients for plants, with the need to monitor soil salinity.

References

[1] https://upload.wikimedia.org/wikipedia/commons/1/1c/DZ_26_Sidi_Naamane_District.svg. Consulter le : 01/06/2023

[2] Almawaldi H. and all., Effects of soil particle size fractions and organic amendments on soil organic carbon fractions and microbial properties. Geoderma. (2021), vol. 383, 114772.

[3] Bueé M. and all., Dynamics and interactions of dissolved organic matter and inorganic nutrients in agricultural soils: a review. Agronomy for Sustainable Development. (2020), vol. 40(6), 1-20.

ISBN: 978-81-970666-1-0

Series: AIJR Abstracts

DOI: 10.21467/abstracts.170