

STUDY OF THE IMPACT OF SEWAGE SLUDGE ORGANIC MATTER ON SOIL FERTILITY

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INTRODUCTION

Agricultural recycling of organic and industrial by-products, particularly sewage sludge, is more relevant than ever given the depletion of organic matter in soils everywhere. In addition to their agronomic value (fertilizing and soil-improving properties), these residues can provide a solution within a global policy of sustainable environmental protection.

Using residual sludge as a soil conditioner involves the following points:

- Eliminating a potential source of organic pollution through the soil's self-purifying power.
- Improving and maintaining fertility levels to increase yields.
- Using a disposal method that is more advantageous and less costly than incineration or landfilling.

APPROACH

The study required setting up a field trial (at the Mehdi-Boualem Station) on an area of 2000 m² using latin square design with 5 doses of sewage sludge from the Béni-Messous WWTP: D0 = 0 t/ha, D1 = 15 t/ha, D2 = 30 t/ha, D3 = 45 t/ha, D4 = 60 t/ha applied in two halves (May 2015 and May 2018), a dose of Baba Ali farm manure as a control (FM = 6 t/ha), and a durum wheat crop (Chen's variety).

MAIN RESULTS

Characterization of sludge from the Béni-Messous WWTP:

The Béni-Messous WWTP, which uses a medium-load activated sludge treatment process, has a current total capacity for 500,000 population equivalent for a nominal flow of 100,800 m³/day.



Photo of the Béni-Messous WWTP



Operating principle of the Béni-Messous wastewater treatment plant (WWTP)

Composition of sludge and farmyard manure:

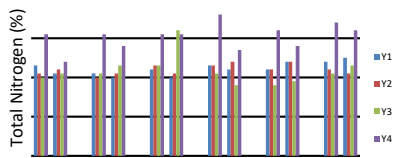
| Parameters studied | Sludge of Beni-messous | | Farmyard of Baba Ali | |
|--------------------|------------------------|------------|----------------------|------------|
| | First lot | Second lot | First lot | Second lot |
| DM(%) | 53,33 | 61,17 | 87,56 | 87,56 |
| PH | 7,90 | 6,25 | 8,48 | 8,05 |
| EC (mS/cm) | 1,98 | 0,91 | 7,41 | 7,08 |
| TN(%) | 1,22 | 3,51 | 2,14 | 2,41 |
| OC (%) | 7.74 | 17.15 | 16.10 | 22.00 |

TN Sludge(3.51%) > Farmyard (2.41%)

Effect of different sludge doses on some soil chemical properties:

The results of the analysis of several chemical parameters of the soil amended with sludge at 2 depths (Horizons 1 and 2) and 4 periods corresponding to the four years of monitoring (Y1, Y2, Y3, Y4) are shown in the figures below.

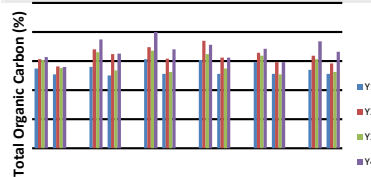
Effect of different sludge doses on the variation of total nitrogen content in the soil.



Temporal variation of total soil nitrogen content according to different treatments

Total Nitrogen in the soil (0.36%) ↑ in year 4 at dose D3 ≈ Total Nitrogen Farmyard manure

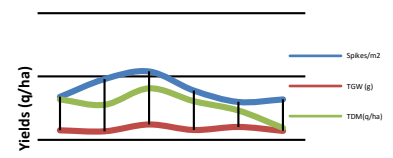
Effect of carbon different sludge doses on the variation of organic carbon content in the soil.



Temporal variation of soil organic carbon contents according to the treatments applied

- Organic Carbon ↑ in year 4 at doses D1 (1.87%) and D2 (2%)
- Organic Carbon ↑ in year 2 at dose D3 (1.85%)

Estimation of yields (q/ha).



influence of different sludge doses on yields

Highest yield (90.75 q/ha) at dose D2.



Appearance of the cultivated wheat

Photo representing the ears of Chen's variety durum wheat obtained at the maturity stage.

CONCLUSION

The main conclusions are as follows:

- A noticeable improvement in the levels of fertilizing elements in the soil during the fourth year of experimentation, which corresponds to the second application, clearly demonstrating the cumulative effect.
- Particularly interesting effect on yield at the dose D2 = 30 t/ha.
- The study of the impact of different sludge doses on the soil and plant content of heavy metals (Cu, Zn, Pb, Cd) yielded satisfactory results. In fact, the concentrations of these elements in the soil and wheat grains did not exceed the limit values recommended by the NA 17731 standard (Algerian standard established with the contribution of the INRAA soil division and published in 2017 by L'IANOR), which aims to set definitions and specifications for sludge and the conditions for its use.