RESEARCH CONCERNING THE INFLUENCE OF CITY SLUDGE AND OF MINERAL FERTILISERS ON GRAIN MAIZE AND SUN-FLOWER CROPS IN THE CONDITIONS OF THE BANAT’S PLAIN

CERCETĂRI PRIVIND INFLUENŢĂ NĂMOLULUI ORĂŞENESC ŞI A FERTILIZANŢILOR MINERALI ASUPRA CULTURILOR DE PORUMB BOABE ŞI FLOAREA-SOARELUI ÎN CONDIŢIILE CÂMPIEI BANATULUI

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Abstract: City sludge from water plants are important fertiliser resources for agriculture. Using city sludge is necessary both in maintaining soil fertility and in recycling in a non-polluting way human wastes. Agricultural and environmental policies of the EC are oriented towards recycling these fertilising resources through agricultural production processes with respect for environmental protection standards. Research was carried out in order to develop true solutions for valorising city sludge at the Water Plant in Timişoara in the conditions specific to Western Romania.

Rezumat: Nămolurile orăşeneşti provenite de la staţiile de epurare constituie importante resurse fertilizante cu potenţial de a fi valorificate în agricultură. Utilizarea nămolului orăşenesc în agricultură se impune, pe de o parte, ca necesitate de susţinere a fertilităţii solurilor iar pe de altă parte ca necesitate de reciclare nepoluantă a acestor deşeuri provenite din activităţi antropice. Orientările politicilor agricole şi de mediu ale CE sunt spre recircularea acestor resurse fertilizante prin procesul de producţie agricolă, în condiţiile respectării normelor de protecţie a mediului. Cercetările efectuate sunt în sensul celor prezentate anterior, în scopul găsirii unor soluţii concrete de valorificare a nămolului orăşenesc de la Staţiia de epurare Timişoara în condiţiile specifice Regiunii de Vest a României.

Key words: urban agriculture, sun-flower crops, maize crops, mineral fertilisers, city sludge, fertilising resources

Cuvinte cheie: agricultura urbană, cultura de floarea-soarelui, cultura de porumb, fertilizanţi minerali, nămol orăşenesc, resurse fertilizante

INTRODUCTION

Agriculture needs, on one hand, organic matter to preserve soil fertility, as soils have turned poor in humus because of intensive production systems, while environmental protection, on the other hand, need solutions for the non-polluting valorising of wastes from agricultural, industrial, and urban management activities.

Spreading organic wastes on agricultural lands, other than agricultural ones, with a view to valorise the fertilising elements present in them involves a series of safety measures in order to prevent soil loading with heavy metals and pathogenic agents and their transfer into plants, animals, and humans later on.

At present, about 30% of the sludge from EC water plants are used in plant production, and in some countries, such as Great Britain, for example, it reaches 40% of an annual production of 10 billion t of dry substance.

In Romania, there are considerable amounts of city sludge, from urban activities, and the crisis in organic fertilisers asks for the use of this sludge in the agricultural production circuit.
Our research, on the ground of what we have presented above, aimed at valorising city sludge from the Water Plant in Timisoara in agriculture, in the conditions of the Western Plain.

**MATERIAL AND METHOD**

Research carried out aimed at valorising city sludge from the Water Plant in Timisoara and at assessing its impact on production in maize and sunflower crops when applied in different doses.

Experiments were set on the agricultural land of the village of Becicherecul Mic (County of Timiş), within the SC Betim SA, at about 18-20 km far from Timişoara.

Within this experiment, we tested the influence of city sludge in doses of 10, 25, 50, 75, and 100 t/ha, together with mineral fertilisers (N\textsubscript{100}P\textsubscript{70}) and an untreated variant, the control.

We cultivated the Florencia maize hybrid and the Select sunflower hybrid, area hybrids recommended for the Western Plain.

**RESULTS AND DISCUSSIONS**

Our research, on the ground of what we have presented, aimed at valorising city sludge from the Water Plant in Timisoara in agriculture, in the conditions of the Western Plain (Romania).

Experiments were set on the agricultural land of the village of Becicherecul Mic (County of Timiş), within the SC Betim SA, at about 18-20 km far from the source of the city sludge.

Experiments were set on a weakly gleyed cambic faesiol (cambic chernozem) with a clayish-argyle texture, weak acid reaction, well supplied in humus, nitrogen, and potassium, and weakly supplied in phosphorus.

Research was carried out between 2001 and 2003, years with variable climate conditions for maize and sunflower in the Western Plain.

Results in maize are shown in Table 1 and Figure 1. They point out the fertilising contribution of city sludge from the Water Plant in Timisoara.

Table 1

<table>
<thead>
<tr>
<th>Variant</th>
<th>Yield (kg/ha)</th>
<th>Relative values (%)</th>
<th>Differences (kg)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertiliser</td>
<td>4044.00</td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 t/ha sludge</td>
<td>4797.67</td>
<td>118.64</td>
<td>753.67</td>
<td>***</td>
</tr>
<tr>
<td>25 t/ha sludge</td>
<td>5180.33</td>
<td>128.10</td>
<td>1136.33</td>
<td>***</td>
</tr>
<tr>
<td>50 t/ha sludge</td>
<td>5593.00</td>
<td>138.30</td>
<td>1549.00</td>
<td>***</td>
</tr>
<tr>
<td>75 t/ha sludge</td>
<td>5236.00</td>
<td>129.48</td>
<td>1192.00</td>
<td>***</td>
</tr>
<tr>
<td>100 t/ha sludge</td>
<td>4820.33</td>
<td>119.20</td>
<td>776.33</td>
<td>***</td>
</tr>
<tr>
<td>N100 P70</td>
<td>5609.00</td>
<td>138.70</td>
<td>1565.00</td>
<td>***</td>
</tr>
</tbody>
</table>

DL\textsubscript{5%} = 142.713; DL\textsubscript{1%} = 200.322; DL 0.1% = 282.808
Figure 1. Influence of city sludge and of mineral fertilising on grain maize yield (2001-2003)

Average values of the crops in the 3 experimental years show the positive effect of applying city sludge on maize crops, i.e. yield increases between 18.64% and 38.70% or, in absolute values, between 753.67 kg/ha and 1,549 kg/ha compared to the control, the differences being ensured statistically.

The maximum yield increase was when applying a dose of 50 t/ha sludge (1,549 kg/ha) comparable with the fertilising effect of chemical fertilisers N₁₀₀P₇₀.

When applying sludge doses larger than 50 t/ha, maize yields decrease. For 100 t/ha, the maximum dose we tested within our research, yield almost reaches the same level as when applying 10 t/ha of sludge, but still superior to the control.

Similar effects were also in sunflower crops, results being shown in Table 2 and Figure 2, pointing out the fertilising effect of this fertilising resource.

Applying city sludge on sunflower crops shows efficiency through increases between 17% and 36.4%. Differences in absolute figures are between 246 kg and 526.67 kg and are statistically ensured.

Maximum yield increase in the case of variants fertilised with city sludge is of 527.26 kg when applying a dose of 50 t/ha of sludge and comparable with the fertilising effect of chemical fertilisers N₁₀₀P₇₀.

Increasing sludge doses to 75 t/ha and to 100 t/ha respectively results in a decrease of the yield in sunflower. For a dose of 100 t/ha the maximum dose tested within our research yield decreases considerably and almost reaches the yield obtained when fertilised with 10 t/ha
of sludge, which does not justify the application of such a dose technically or economically.

Yield results during the 3 experimental years both in maize and sunflower point out the fluctuating influence of climate conditions, more favourable in 2001 and 2002 (Figure 3).

**Table 2**

Influence of application of city sludge and of chemical fertilisers on sunflower crops (2001-2003)

<table>
<thead>
<tr>
<th>Variant</th>
<th>Yield (kg/ha)</th>
<th>Relative values (%)</th>
<th>Differences (kg)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fertiliser</td>
<td>1448.33</td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 t/ha sludge</td>
<td>1694.33</td>
<td>116.99</td>
<td>246.00</td>
<td>***</td>
</tr>
<tr>
<td>25 t/ha sludge</td>
<td>1849.33</td>
<td>127.69</td>
<td>401.00</td>
<td>***</td>
</tr>
<tr>
<td>50 t/ha sludge</td>
<td>1975.00</td>
<td>136.36</td>
<td>526.67</td>
<td>***</td>
</tr>
<tr>
<td>75 t/ha sludge</td>
<td>1858.33</td>
<td>128.31</td>
<td>410.00</td>
<td>***</td>
</tr>
<tr>
<td>100 t/ha sludge</td>
<td>1714.00</td>
<td>118.34</td>
<td>265.67</td>
<td>***</td>
</tr>
<tr>
<td>N100 P70</td>
<td>1985.33</td>
<td>137.08</td>
<td>537.00</td>
<td>***</td>
</tr>
</tbody>
</table>

DL5% = 53.43; DL1% = 74.99; DL 0.1% = 105.88

![Figure 1. Influence of city sludge and of mineral fertilising on sunflower yield (2001-2003)](image-url)
Results concerning the possibility of valorising city sludge from the Water Plant in Timisoara on maize and sunflower in the soil land climate conditions of the Western Plain (Romania) are encouraged due to the yield increased we have got. These sludges can be an alternative to fertilizing soils on areas close to the places where they are stored and when there are no other organic fertilizing possibilities or when they are not enough, and when chemical fertilizing costs based on mineral fertilizing are much superior.

Excessive sludge fertilization is not recommended however, city sludge use in fertilizing being ruled through present legislation.

Soils to be fertilized with city sludge should be plane (slope < 2%), have a argyle, clayish, clayish-dusty structure with medium permeability, good drainage, with no risks of flooding, pH higher than 6.9, medium cation exchange capacity, heavy metal charge lower than 20%, and a good buffer capacity. Fertilizing with these sludges should be done once and shall not be repeated soon, in accordance with legal stipulations, in order to protect the environment.

CONCLUSIONS
City sludge from the Water Plant in Timisoara is an impressive resource of fertilising elements with valorising potential in agriculture.

Research carried out between 2001 and 2003 in the conditions of the Western Plain at the SC Betim SA (County of Timiş) point out the fertilising potential of city sludge.

Yield increases in maize and sunflower through the increase of doses from 10 to 100 t/ha justify the use of this resource in fertilising the crops on which it was tested, i.e. grain maize and sunflower.
The recommended dose for the soil and climate conditions in the Western Plain both in maize and sunflower is around 50 t/ha, a dose that ensures a high level of the yield, equal to that of intensive fertilising with chemical fertilisers.

We recommend respect of methodological standards in using city sludge in agriculture to get the advantages needed together with environmental protection.

**LITERATURE**

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