The Remanent Effect of Compost Made From Sewage Sludge Used as Fertilizer on Forage Plants

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Abstract
In the platform of applied research of Ecology and the Environment protection discipline from the Animal Science and Biotechnologies Faculty Timisoara was investigated during 3 years the remanent effect of compost made from sewage sludge used as organic fertilizer on forage plants. The experiment was done in vegetation pots, the experimental block being organized on 15 variants in 3 repetitions. Was used a forage plants mixture in equal parts of Lolium perenne and Trifolium repens, being studied the germination, growth and development of plants. In this paper are presented the results from the second year of study, the green mass productions at three harvestings. The obtained results show a good production of green mass in the second year, the productions being directly proportional to the amount of compost administered in the first year as fertilizer. Compared to the first year, was obtained a higher amount of green mass production in the case of fertilization with quantities higher than 100 t compost / ha.

Keywords: compost, forage plants, remanent fertilizer effect, sewage sludge

1. Introduction
Use in agriculture of compost as organic fertilizers require detailed studies on their chemical, physical and biological characteristics. In addition to assessing their nutritional value, agronomic and commercial, is required to determine their chemical characteristics for the knowledge level of harm and / or toxicity compared with the various compounds. In addition it is necessary to use a permanent agro technical improvement of compost or they may come from different biodegradable materials and preparation techniques. [1, 2]

Research conducted to date have shown, for example, composted or non-composted municipal sludge contain high amounts of organic matter, but also other elements such as the bivalent cations Ca, Mg, heavy metals, etc. Fertilization of lawns with compost in amounts of 15-20 tonnes per hectare per year leads to a fodder production comparable to that obtained with 150 units by mineral nitrogen fertilization, 100 kg phosphorus and 100 units potassium. In addition, compost determine proliferation of valuable species of perennial grasses and legumes, feed with a better digestibility and conversion in a grade animal products higher than that achieved by mineral fertilization. Compost often has a slightly alkaline reaction (7, 5 - 8) fact which can be used as amendments on low or moderately acidic soil. Therefore, their application on agricultural land could increase the organic matter content of soil and its buffering capacity and cation exchange. [1, 3, 4]

In the literature are signals that point out that in parallel with the beneficial effects are often severe and negative consequences that limit the uncontrolled application of these materials on the ground. Adverse effects are predominantly due to chemical components found in high concentrations, exceeding the maximum allowable (heavy metals, etc.), that and certain toxic organic compounds, soluble salts, which can pollute both soil and other environmental, such as surface water and groundwater or vegetation.
Concentration of heavy metals in sewage sludge is, usually, a very important limiting factor for application to agricultural land, due to potentially adverse effects on plant biomass and their transfer to food in the whole food chain. [2, 5, 6]

Therefore, in the future, to report how to obtain compost and use the agro technical system, will have to pay greater attention to identify these chemicals, of how their translocation from soil to plant and the consequences that may occur in the food chain soil-plant-animal-human.

In this way, the objective of this work was to study the effect of fertilizer of some excessive doses of compost obtained from city sewage sludge on the production of phytomass fodder in the second year of vegetation.

2. Materials and methods

Compost used for fertilization was obtained from a mixture of sewage sludge from urban stations with chopped wheat straw. Research has focused on the values of 25 t (V1), 50 t (V2), 100 t (V3) and 250 t (V4) compost per hectare, with fertilization only in the first year of vegetation. Within each experimental version, including version control (M) formed many 5 rehearsals.

Experimental block consisting of 45 vegetation vessels was located in the vegetation house within the discipline of Ecology from F.Z.B. Timișoara. The vegetation vessels had an area of 314 square cm and a volume of 7850 cubic cm.

A fodder plants mixture was used as biological material in equal parts of red clover (Trifolium pratense) and tall fescue (Festuca arundinacea). [7-9]

By weighing, was examined the mass production of phytomass obtained from three harvests in May, July and September. The plants were harvested in full blooming stage of red clover. This paper presents the results obtained in the second year of vegetation.

3. Results and discussion

Table 1 shows the production of green mass in first year (2008).

<table>
<thead>
<tr>
<th>Variant</th>
<th>Cod</th>
<th>First harvest</th>
<th>Second harvest</th>
<th>Third harvest</th>
<th>Total harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{x} \pm S_x$</td>
<td>$\bar{x} \pm S_x$</td>
<td>$\bar{x} \pm S_x$</td>
<td>$\bar{x}$</td>
</tr>
<tr>
<td>M control</td>
<td>control</td>
<td>22.42 ± 6.22</td>
<td>13.95 ± 3.62</td>
<td>14.86 ± 5.77</td>
<td>17.08</td>
</tr>
<tr>
<td>V1</td>
<td>25 t / ha</td>
<td>24.32 ± 3.13</td>
<td>18.3 ± 4.12</td>
<td>14.22 ± 4.92</td>
<td>18.95</td>
</tr>
<tr>
<td>V2</td>
<td>50 t / ha</td>
<td>24.56 ± 5.12</td>
<td>20.66 ± 5.33*</td>
<td>17.32 ± 4.58</td>
<td>20.85</td>
</tr>
<tr>
<td>V3</td>
<td>100 t / ha</td>
<td>27.14 ± 6.21*</td>
<td>22.73 ± 6.88**</td>
<td>16.09 ± 4.97</td>
<td>22.00</td>
</tr>
<tr>
<td>V4</td>
<td>250 t /ha</td>
<td>21.75 ± 3.59</td>
<td>19.01 ± 5.21*</td>
<td>15.77 ± 2.76</td>
<td>18.84</td>
</tr>
</tbody>
</table>

* $p \leq 0.05$

** $p \leq 0.01$

It is noted that all three harvest times of 1 year of vegetation, we obtain a green mass production related directly proportional to the amount of compost as organic fertilizer provided.

At first harvest, the highest green mass production is obtained at V3, and the difference from the control group 4.72 t (18.7%) is significant at the 0.05 threshold. The second moment of harvest, the largest amount of green mass is obtained for the variant fertilized with 100 tonnes per ha followed by versions with 50 t and then the 250 t compost per hectare. Compared to the control, the difference of 8.78 t / ha green mass obtained from version V3 is distinctly significant (p <0.01), and if V2 and V4 variants obtained differences are significant only in the threshold of p < 0.05. The third scythe similar results are obtained do not change the relationship of proportionality between the amounts of compost fertilization and managed for fertilization.

The analyze of total green mass production highlights the fact that excessive fertilization with 250 t of compost on ha it will be obtained a smaller green mass production, comparable with the production obtained in the control. These means that the excess of organic material in the ground will have a negative effect in plant growth and development of feed mixture studied.

Table 2 presents the mass production of green in the second year of vegetation.
Table 2 – Green mass production of the second year of vegetation

<table>
<thead>
<tr>
<th>Variant</th>
<th>Cod</th>
<th>First harvest $x \pm S_x$</th>
<th>Second harvest $x \pm S_x$</th>
<th>Third harvest $x \pm S_x$</th>
<th>Total harvest $x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>control</td>
<td>45.78 ± 5.34</td>
<td>17.36 ± 2.59</td>
<td>14.55 ± 4.67</td>
<td>25.90</td>
</tr>
<tr>
<td>V₁</td>
<td>25 t / ha</td>
<td>42.56 ± 2.13</td>
<td>22.47 ± 3.09</td>
<td>17.33 ± 3.68</td>
<td>27.45</td>
</tr>
<tr>
<td>V₂</td>
<td>50 t / ha</td>
<td>50.66 ± 4.76*</td>
<td>28.19 ± 4.73*</td>
<td>20.44 ± 3.53</td>
<td>33.10</td>
</tr>
<tr>
<td>V₃</td>
<td>100 t / ha</td>
<td>57.49 ± 7.77**</td>
<td>29.41 ± 4.39*</td>
<td>17.55 ± 4.89</td>
<td>34.82</td>
</tr>
<tr>
<td>V₄</td>
<td>250 t / ha</td>
<td>48.51 ± 4.54</td>
<td>20.39 ± 1.37</td>
<td>11.77 ± 1.02</td>
<td>26.89</td>
</tr>
</tbody>
</table>

In comparison with the first year, mass production of the second year green vegetation (2009) is superior to the one the first year of vegetation. Big differences are registered in the first harvest. As the first scythe, for all variants, it will be obtained a production of about twice bigger from the one in the previous year. In case of fertilized with 100t of compost per ha (V₃) performance compared with yields from the same variation in fertilization the first year of vegetation, the green mass production is 2.1 bigger. Following, in order, with a yield of 2.06 times the variant fertilized with compost 50t per ha and then the variant V₄.

The green mass production decreases in the second harvest moment, but retains significance of differences between variants with the best green mass production (V₃ and V₂). Similar results are obtained also in the third harvest moment. The analyze of the total green mass production obtained in the second year of vegetation, consecutive with the first compost fertilization, highlights the superior productive performances of the first year fertilization. This situation is the consequence of remaining in the ground of the compost that in a year improves their potential fertilizer. Second is possible that the presence of organic material in the ground to favour the constitution of a specific edaphically biogenesis that stimulates adsorption and absorption processes on the reticular system. We consider that compost fertilization in moderate quantities assures over the years a good retainable fertilization effect, with benefice effects over the green mass production in case of a mixture feed formed from equal parts with Trifolium pratense and Festuca arundinacea. The remanence doesn’t show if the soil fertilization has quantities of over 100 t of compost on ha.

4. Conclusions

In case of the fodder mixture in equal parts of Trifolium pratense and Festuca arundinacea, the favourable effect of soil fertilization with compost is more evident in the first year compared to the second year of vegetation.

2. Adding quantities of 50 t and 100 t compost per hectare provides at the first harvest in the second year of vegetation a green mass production of over 2 times higher. The fertilizer effect decrease in second and third harvest but are higher in comparison with the same moments of harvest from the first year of vegetation.

3. The presence in soil of compost administrated in the first year of vegetation and stimulates the processes of pedogenesis and edafobion activity that enhances the potential of soil fertilizer.

References

3. *** Sludge Treatment and Disposal – Management Approaches and Experiences, ISWA & EEA, 1997