INFLUENCE OF DIFFERENT AMENDMENTS ON THE DYNAMICS OF MOLDS IN CHERNOZEM SOIL OF DOBROGEA

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Abstract

The aim of the current paper was to observe the effect of the application of organic and inorganic amendments on the dynamics of the moulds abundance. Research showed that the average total number of culturable moulds ranged between 4.44-13.2x10⁵ CFU/g dry soil (Valu lui Traian). Moulds density also increased significantly following the administration of specific biofertilizers (Biovin, BactoFil Professional, Mycos Green). Inorganic fertilizers have not a positive effect on microbial density values, which were more or less similar to those reported for the control.

Key words: biofertilizers, humus, moulds, soil fertility.

INTRODUCTION

The researches conducted in the Turn of the Dobrogea (Valu lui Traian) aim to establish a pattern of chernozem soil biological reconstruction by applying various amendments aimed at stimulating moulds abundance, with the targets:
- degradation and decomposition of organic matter;
- restoration of soil structure;
- recovery of the stock of humus.

MATERIAL AND METHOD

Experimental plot: 7 hectares of arable land outside the village Valu lui Traian, Constanta; Culture: wheat, Josef variety.
Time of experimentation: the agricultural year 2010-2011 both in different phases of the wheat growing season and after harvest.
Experimental versions: 7 variants.
Biovin fertilizers were administered for the first time in Dobrogea.
Biovin is produced through a technological process from grape kernels. 12 years of research proved the following: it aerates the soil, improves it (it contains up to 70% humus makers - 8x10⁷ CFU/g), it enriches the soil with microorganisms that create humus (8x10⁹ aerobic microorganisms per gram) [1].

Table 1. Fertilizers administered

<table>
<thead>
<tr>
<th>Experimental plots</th>
<th>Fertilizers administered</th>
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<tbody>
<tr>
<td>V1</td>
<td>100 kg/ha N₁₃P₁₅K₁₅ in autumn; 150 kg/ha NH₄NO₃ in early spring.</td>
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<tr>
<td>V2</td>
<td>Biovin 400 kg/ha; Biovin 30 de l/ha - ½ at herbicide stage; -· at flour stage.</td>
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<tr>
<td>V3</td>
<td>Manure - 15t/ha in autumn.</td>
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<tr>
<td>V4</td>
<td>Biovin 30 de l/ha - ½ at herbicide stage; -· at flour stage.</td>
</tr>
<tr>
<td>V5</td>
<td>Biovin 150 kg/ha - administered during sowing; NH₄NO₃ – 150 kg/ha: -· 40 kg/ha in early spring; -· 50 kg/ha at herbicide stage; -· 60 kg/ha at flour stage.</td>
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<tr>
<td>V6</td>
<td>Biovin 375 kg/ha; Biovin 30 l/ha - ½ at herbicide stage; -· at flour stage; 1 mc Green Mycos; 1 l Bactofil Professional.</td>
</tr>
<tr>
<td>V7</td>
<td>March – were not applied amendments.</td>
</tr>
</tbody>
</table>
Bactofil Professional is a product for improving the soil biological quality and contains nitrogen fixing bacteria 5.2x10⁶ CFU/ml, phosphate-solubilization bacteria, and heterotrophic bacteria that stimulates the decomposition of organic matter [5].

Green Mycos is a product containing arbuscular mycorrhizal fungi and a number of factors that stimulate the establishment of symbiosis, improving the soil quality up to 20 years [1].

Description of working methods:
The experiments have taken place on a 7 ha, which was divided in 7 variants, each variant being administered a different type of fertilizer in different quantities and periods.

Quantitative determination of microbial abundance was done by decimal dilutions of soil followed by inoculation of known quantities on solid nutrient media Bergey’s [2], Papacostea, P. [4]. For this purpose, after weighing the samples were inoculated on culture medium with a specific composition. Thus, to determine the number of total culturable molds it has been used nutrient:

- Czapek-Dox medium from Merck (NaNO₃ 3g; K₂HPO₄ 1g; MgSO₄ 0.5g; KCl 0.5g; FeSO₄ samples; Saccharine 30g; Agar 17-20g; pH 5.5; it was sterilized for 30 min at 115°C);
- Sabouraud medium from Merck (CaCl₂ 0.5g; 0.1 g K₂HPO₄; KH₂PO₄ 0.1g; 10% MoO₃ 0.1ml; 0.05ml FeCl₃ 10%; it was sterilized for 30 min at 115°C);
- Rose Bengal (glucose 20g; Agar 18g; Rose Bengal 33mg; potatoes extract 500ml; pH 6; it was sterilized for 30 min at 115°C), (prepared in laboratory);
- PDA (Potato Dextrose Agar) - Glucozā 20g; Agar 18g; potatoes extract 500ml; pH 5.5; it was sterilized for 30 min at 115°C; (prepared in laboratory) [3]. Three were inoculated Petri plates on each variant.

Soil samples were collected from about 15 cm depth in order to perform quantitative analysis of molds throughout the agricultural year 2010-2011, both in different phases of the wheat growing season and after watching his collection for development of microbial growth, depending on the variant.

The total number of molds per gram of soil was calculated by using the formula: no. molds = X colonies x dilution x 10 x 100/100-U, where X = average of colonies grown on culture medium, 10 = balancing coefficient of 0.1 ml of inoculum in the reporting of dilution soil U% = soil moisture [6].

RESULTS AND DISCUSSION

Microbial abundance was maximal in V₃ (manure), the only variant which showed an increase from 10.56x10⁵ CFU/g dry soil, in October to 14.43x10⁵ CFU/g dry soil, in August (Fig.1).

V₆ (mycorrhiza, Bactofil Professional) shows the smallest decrease in abundance microbial from October 2010, 12.42 x10⁵ CFU/g dry soil, until August 2011, 6.58x10⁵ CFU/g dry soil, compared with other variants (Fig. 1).

V₁ (chemical) has not a positive effect on microbial abundance because it was observed a significant decrease from 23.02x10⁵ CFU/g dry soil in October, to 5.07x10⁵ CFU/g dry soil in August (Fig.1).

![Fig. 1. Dynamic variation of monthly molds in the crop year 2010-2011](image)

Microbial abundance was found:

- highest in October, V₄ (Biovin liquid) 14.89x10⁵ CFU/g dry soil, V₅ (Biovin, ammonium nitrate) 14.09x10⁵ CFU/g dry soil, decreasing in August V₄ (Biovin liquid) 1.46x10⁵ CFU/g dry soil V₅ (Biovin, ammonium nitrate) 2.8x10⁵ CFU/g dry soil; have similar values, superior version control V₃ 3.96x10⁵ CFU/g dry soil, but insignificant in the dynamic abundance moulds (Fig.2);
- the lowest value was determined in October on the V₂, 9.99x10⁵ CFU/g dry soil after applying biofertilizers decreasing to 1.82x10⁵ CFU/g dry soil in August (Fig.2).
Most microbial dynamics has occurred $V_3$ (manure), $13.24 \times 10^5$CFU/g dry soil and $V_6$ (mycorrhiza, Bactofil Professional), $7.45 \times 10^5$CFU/g dry soil (Fig.3).

Other experimental variants:
- $V_5$ (Biovin, ammonium nitrate) $6.74 \times 10^5$CFU/g dry soil, $V_4$ (Biovin liquid) $6.4 \times 10^5$CFU/g dry soil, showed the lowest abundance of molds, but with values superior version control ($V_7$) $5.93 \times 10^5$CFU/g dry soil.
- $V_2$ (Biovin solid, liquid) $4.44 \times 10^5$CFU/g dry soil, showed the lower values (Fig. 3).

CONCLUSIONS

We recommend as models for reconstruction of the soil:
- $V_3$ (manure) - the highest abundance of molds cultivation $13.24 \times 10^5$CFU/g dry soil (Fig.3); show an increase of 223% compared to the control variant $5.93 \times 10^5$CFU/g dry soil (Fig.3);
- $V_6$ (Biovin, Bactofil Professional; Green Mycos) – $7.45 \times 10^5$CFU/g dry soil (Fig.3), show an increase of 126% compared to the control variant $5.93 \times 10^5$CFU/g dry soil (Fig. 3).

Our preliminary data show that organic amendments with complex composition have a direct effect on the abundance and diversity of soil and influence indirectly the microbial metabolism and nutrient cycling rate.

Rather poor development of molds in Valu lui Traian, is due partly weather conditions, excessive drought.

REFERENCES