

The effect of fungi of the genus *Trichoderma* on phytoavailability cadmium and mitigation of disturbances in photosynthesis of oat (*Avena sativa*)

Wpływ grzybów z rodzaju *Trichoderma* na fitoprzyswajalność kadmu oraz łagodzenie zakłóceń procesu fotosyntezy roślin owsa (*Avena sativa*)

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The aim of conducted research was to determine the effect of the subsoil inoculation with *Trichoderma* genus fungi on cadmium phyto-availability and process of photosynthesis at oat (*Avena Sativa*). The two-factor pot experiment was carried out in 4 replications. The first variable factor was the presence (+T) or absence (-T) of *Trichoderma* genus fungi applied into the soil in the form of a granular formulation *Trianium-G* in the quantity recommended by the manufacturer (Koppert B.V.), i.e. the first application 750 g·m⁻³ while the second 375 g·m⁻³ subsoil. Another variable factor consisted of cadmium doses applied into the soil in amounts of 0, 3, 5, 10, 20, 25 mg Cd·kg DM soil.

Slightly acidic soil of pH_{KCL} = 5,60 and granulometric composition of silty soil was used as a subsoil for experiment. The soils contained an average of 7.1 g·kg⁻¹ DM of organic carbon, and 1.12 g·kg⁻¹ DM of nitrogen. Total content of cadmium was 0.703 mg·kg⁻¹ DM. Uniform basic nutrition (0.2 g N; 0.05 g P; 0.2 g K i 0.025 g Mg per 1 kg of soil) was applied for all objects whereas cadmium was incorporated in the form of water solution of 3CdSO₄·8H₂O.

Plants were grown for 120 days maintaining the temperature at the level of 23/15°C, at photoperiod 16/8 (day/night). Soil moisture was kept stable at 40% in the first phase of experiment and 50% in the second phase.

During plant vegetation period, disturbances of photosynthesis process were monitored by measurements of chlorophyll content and fluorescence parameters (on the first, third and flag leaf) using fluorometer WALTZ. Following parameters were determined: F₀ – zero fluorescence of objects adapted to darkness, F_m – maximum fluorescence, F_v – variable fluorescence, F_v/F₀ – maximum efficiency of water splitting at the donor side of PSII and F_v/F_m – maximum photochemical efficiency of PSII. After completion of the pot experiment the yield of the plant was determined and the content of cadmium in roots and above ground parts was determined by means of atomic absorption spectrometry (AAS, using Hitachi Z-2000 Japan).

Obtained results indicate, that increasing cadmium concentration in the surface did not influence on the yield of roots and straw of oat, whereas it caused significant decrease of grain yield. Moreover, cadmium concentration in roots and above ground parts of oat was increasing proportionally to increasing amount of that metal in the surface. The biggest amounts of cadmium were cumulated in roots, a little less in straw and the least in grain. Inoculation of surface by *Trichoderma* mycelium did not influence significantly on the yield and cadmium assimilability by roots and above ground parts of oat.

The biggest changes in values of chlorophyll fluorescence parameters were noted on the first leaf – it results, that as the plant grows defending mechanisms were developed, which alleviated acting of stressor. Significant influence of *Trichoderma* on alleviating, or increasing disturbances of the process of plants photosynthesis was not stated. The growth of chlorophyll amount was observed as the plant grows, and addition of *Trichoderma* to the surface had positive influence on the amount of dye contained in leaves.