## SUMMARY

### Effect of soil fertilization with organic materials on the health status of cultivated plants and the community of root zone microorganisms

**Jędrzej Mastalerz, M. Sc.**

**Key words:** organic fertilization, agricultural waste utilization, sewage sludge, compost, winter oilseed rape, winter wheat, potato, soil microorganism community, health status of plants.

In 2017-2020, in a long-term static field experiment, research was carried out on the effect of organic fertilization on the health of winter rape, winter wheat and potato, as well as on the presence of microbial communities inhabiting the soil, root zone and roots of the tested plants. The experiment was set up in Bałcyny near Ostróda (53.60 ° N, 19.85 ° E) in 2004 using the randomized block method in three repetitions. In the one-factor experiment, manure, modified sewage sludge and composts produced from municipal waste and municipal green waste at a dose of 5 t dry mass · $ha^{-1}$ were used twice in rotation for winter oilseed rape and potato.

The studies showed that fertilization with dried and granulated sewage sludge caused the increase infection of rape by *Verticillium* spp. And the greatest infection of the base of the stalk and wheat roots by fungi of the genus *Fusarium*. This fertilization had the most beneficial effect of plant growth, and despite the greatest infection of rape and wheat by pathogens related to the soil environment, the best healthiness of potatoes was observed. The worse physiological condition of the plants grown in without fertilization and fertilized with compost from urban green waste caused the greatest intensity of striped wheat leaf septoriosis and potato blight. The lowest infection of ears by *Phaeosphaeria nodorum* in the above variants was caused by premature termination of plant vegetation as a result of high intensity of septoriosis of striped wheat.

Fertilization with granulated sewage sludge and composts: from sewage sludge, DANO municipal waste and urban green waste had the best effect on the colonization of the rape and wheat rhizosphere by fungi, and *Paecillomyces variotti* was the most numerously isolated species. In potato, fungi were also relatively numerous in the rhizosphere due to the use of composts: from municipal waste DANO and waste from urban green areas, but more often after

the application of NPK and compost from sewage sludge and straw. There was no clear effect of the tested fertilizers on the number of fungi isolated from the soil of individual plants, which could have been influenced by different weather conditions in the years of the study.

Fertilization with dried and granulated sewage sludge resulted in a significantly greater colonization of the soil under the cultivation of oilseed rape and potato by the bacteria of the genus *Azotobacter* as compared to mineral fertilization. The use of granulated sludge also had a positive effect on the presence of *Pseudomonas* spp. In the soil under the cultivation of wheat and potatoes. Fertilization with DANO compost significantly increased the colonization of the soil under the cultivation of wheat and potato with bacteria of the genus *Bacillus*. The beneficial effect of compost from urban green waste on the number of bacteria phosphate solubilizing bacteria inhabiting the soil from under all tested plants was demonstrated. The greatest abundance of *Azotobacter* and *Bacillus* bacteria from the rapeseed rhizosphere was isolated due to fertilization with granulated sludge, while in wheat studies, these bacteria were the most abundance in the rhizosphere after manure application. In the rape and wheat rhizosphere, a significantly higher abundance of *Bacillus* bacteria was found compared to mineral fertilization. Fertilizing rape with compost from urban green waste had a positive effect on the presence of *Pseudomonas* bacteria, actinomycetes and bacteria phosphate solubilizing bacteria in the rape rhizosphere. Actinomycetes and phosphate solubilizing bacteria were most abundance in the rhizosphere of wheat due to the use of DANO compost. Fertilization of potatoes with sewage sludge and straw compost had a stimulating effect on the colonization of the rhizosphere by bacteria of the genera *Azotobacter*, *Bacillus* and *Pseudomonas*.

Based on the results of nanopore sequencing, poor taxonomic diversity in the community of bacteria inhabiting the soil was demonstrated. *Candidatus* Solibacter dominated in most of the soil samples. The use of manure in rape significantly increased the abundance of *Rhodoplanes* spp., and fertilization with dried and granulated sewage sludge increased the abundance of *Oscillatoria* and *Massillia*. In the soil grown under wheat, a lower dominance of *Ca*. Solibacter was shown than in the studies of other plants, and the use of DANO compost increased the abundance of *Bradyrhizobium*.