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An overview of the doctoral dissertation „**The influence of modified home compost on selected model organisms**" by Lidia Niekraś

The proper segregation of household organic waste and not storing it in plastic bags is the basic condition for the production of high-quality compost. Bio-waste contaminated with plastics, not only loses its fertilizing potential, but also becomes highly harmful waste. On the other hand, collecting biowaste using bags in residential conditions gives advantages like hygiene, elimination of leaks, and reduction of unpleasant odors. The biodegradable bags produced for this purpose meet these expectations, and also provide the opportunity to deposit their contents along with the bag in a home compost bin.

Previous studies have overlooked the assessment of composts containing biodegradable bags produced in home conditions; thus, there is a complete lack of information on the impact of such compost on the soil environment and plants.

This study aimed to assess the impact of BioBag® biodegradable bags on the home compost and the impact of home compost obtained with their participation on selected model plants (*Pisum sativum* L. and *Raphanus sativus* L. var. *sativus*) physiology, including oxidative stress, and on a selected soil phytopathogen: *Rhizoctonia solani* Kühn.

In the first stage of the study, BioBag® biodegradable bags were incubated in distilled water as well as in extracts from home compost and a soil substrate (BioBizz Light-Mix soil), representing the soluble fractions available to plants. During the incubation period, changes in pH and electrical conductivity were monitored. Subsequently, it was assessed whether the changes observed in these environments - resulting from the bag's incubation or the release of substances from it - could influence the growth and development of *Pisum sativum* plants.

It was shown that during several weeks of storage of the bag in distilled water, the pH and electrical conductivity values increased significantly. In contrast, in both extracts, a significant increase in pH was observed, accompanied by a significant decrease in electrical conductivity. The changes observed in distilled water and both extracts had a varied effect on the growth and development of *P. sativum* plants. Biometric measurements of the above-ground and underground parts of two-week-old pea plants growing in hydroponic conditions showed that storing the BioBag® bag in distilled water resulted in a significant weakening of shoot growth with no effect on root growth. The household compost extract had no effect on shoot or root growth. However, the soil substrate extract, significantly stimulated the root growth without affecting shoot length.

In the next stage of the study, three classes of compost were produced in home thermocomposters - traditional compost (K) without BioBag® bags (control compost), compost containing half of the waste collected and deposited in BioBag® bags (K1), and compost consisting exclusively of waste collected and deposited in BioBag® bags (K2). The composts were tested at the Regional Chemical and Agricultural Station in Opole. The following parameters of them were tested: percentage of dry matter, N_{org}, P_2O_5 , K_2O, Mg, salinity, and pH. The results showed that if waste was deposited in BioBag® bags, the C:N ratio was disturbed and a high degree of moisture remained in the piles. It was also demonstrated that the increases of the proportion of film in the composts leads to the decrease of the amount of phosphorus, potassium, magnesium as well as the reduction in salinity. After 6 months of composting, based on the organoleptic assessment, all three composts (K, K1, and K2) could be treated as ready-to-use fertilizers. The tests were repeated after another 3 months of composting. Then additional, horticultural analyses were included. The assessed parameters were: $N\text{-}NO_3$, $N\text{-}NH_4$, P, K, Ca, Mg, Cl, and K:Mg ratio. It was shown that in all three composts the $N\text{-}NH_4$:$N\text{-}NO_3$ ratio reached a value below 1, which allowed to treat them like mature composts. Compared to control (K) compost, the highest statistically significant amount of inorganic nitrogen, potassium, and calcium was found in K1 compost, while the highest statistically significant amount of magnesium was found in K2 compost. The latter compost also had a high C:N ratio. After 9 months of composting, the presence of BioBag® bags was not found to affect the phosphorus and chloride content. Next, the composts obtained in this way were used in laboratory tests to check their effect on *Pisum sativum* and *Raphanus sativus* var. *sativus* plants and a selected phytopathogen – *Rhizoctonia solani*.

Phytotoxicity tests of composts K, K1, and K2 were performed using *Raphanus sativus*. The tests were conducted on substrates containing 12.5%, 25%, and 50% (by volume) of the obtained composts mixed with soil substrate. The inhibition/stimulation coefficients of radish germination were determined in relation to the controls, which were water and soil substrate. The observations made it possible to conclude that the composts and their mixtures had no negative impact on the germination of *R. sativus*. However, the inhibition/stimulation coefficient for shoot and root development indicated a high degree of variability in the effects of the tested substrates on these plant traits.

In the next experiment, the stress potential of composts K, K1, and K2 was assessed using *P. sativum* as a model plant. The plants were grown in vases, in a phytotron, in substrates consisting of the before obtained composts and their mixtures with soil substrate in proportions of 12.5%, 25% and 50% by volume. After five weeks, the activity of selected oxidative stress enzymes, i.e., superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GSH-Px), were measured in the plants, and the concentration of malondialdehyde (MDA), a non-enzymatic marker of lipid peroxidation, was determined. The results revealed a significantly higher and statistically significant level of activity of all the enzymes and a higher level of MDA in tested plants growing in K1 and K2 composts mixtures, compared to plants grown in K composts mixtures. A two-factor analysis of variance showed that both the presence of varying amounts of BioBag® bags in the compost and the proportion of each compost type added to the substrate had a significant effect on the changes in the oxidative stress markers studied.

The potentially high content of microflora makes composts considered fertilizers with properties to inhibit the growth of certain soil phytopathogens. For this reason, the inhibition potential of growth of the soil fungus *Rhizoctonia solani* by compost containing biodegradable bags was studied. Using a modified toothpick bait method to assess mycelium growth, it was proven that the presence of BioBag® bags in compost did not reduce its ability to inhibit the growth of hyphae of this phytopathogen.

Keywords: home composting, biowaste, bioplastics, microplastics, oxidative stress