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Effect of plastic mulches on mycobiome diversity and mycotoxin occurrence in soil

Katherine Muñoz Sepulveda^{1*}, Markus Schmidt-Heydt², Dominic Stoll², Dörte Diehl¹, Rolf Geisen², Gabriele E. Schaumann¹

¹University Koblenz-Landau, Institute for Environmental Sciences, Landau, Germany;

²Max Rubner-Institut, Department for Safety and Quality for Fruits and Vegetables, Karlsruhe, Germany

* Corresponding author: munoz@uni-landau.de

Plastic mulching (PM) is a widely used agricultural management, enhancing soil temperature and improving water conservation, factors that influence the microbiological compartment with unknown effects on mycobiome and mycotoxin biosynthesis. The aim of this study was to assess the effect of PM on mycobiome diversity and mycotoxin occurrence in soil in example of asparagus crops.

Soil samples from white (PM) and green asparagus (bare soil), cultivated in a ridge-furrow system, were obtained from three different depths. The occurrence of five mycotoxins (Deoxynivalenol [DON], T-2, Zearalenone [ZEN], Ochratoxin A and Fumonisin B1) was investigated using LC-HRMS. Total colony-forming unit was used as indicator of mycobiome biomass. Identification of soil-borne filamentous fungi was done by DNA sequencing and characterization of mycotoxigenic capacity via HPTLC-Fl. Soil samples were characterized based on elemental analyses, water content, pH and cation exchange capacity. Soil temperatures and environmental conditions were also recorded.

A significant effect of plastic covers on the investigated soil physicochemical properties was not observed. Differences were observed in relation to soil temperature and water content lengthwise, with values <10% at the topsoil. A higher fungal compartment was observed in covered soil, which can be explained by the effect of PM on soil temperature. The mycotoxins DON and ZEN were found in soil samples with a higher prevalence of DON in covered soils (especially at the topsoil) compared to non-covered soils. Moreover, a high dominance of pathogenic and mycotoxin producing fungal species in the topsoil was observed in both crops, accompanied by the production of the mycotoxin as a possible adaptation response of the producing fungi against environmental conditions at the top soil. Results of this study confirm the effect of plastic covers on soil temperature with clear effects on mycobiome diversity and mycotoxin biosynthesis in soil.

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