MB-09 Suppressing *Fusarium graminearum* and mycotoxins by application of microbial antagonists on infected crop residues

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The orientation towards sustainable agricultural systems requires innovative and integrated methods for control of the fungal disease Fusarium Head Blight (FHB) in wheat to reduce the risk of mycotoxins that contaminate food and feed. Preventive actions against the dominating pathogen *Fusarium graminearum* using biological control agents (BCA) on infected crop residues could contribute to reduced applications of synthetic fungicides. The efforts must focus on microbes with a proven activity against mycotoxin accumulation and a saprophytic lifestyle that is adapted to the environment. Within the Horizon 2020 project MycoKey, we investigated the ability of the fungal species *Clonostachys rosea* and *Trichoderma atrobrunneum* to suppress *F. graminearum* on maize residues and thus to reduce mycotoxins.

At first, we explored the antagonistic activity of *C. rosea* strain 016 on maize stalk pieces infected with *F. graminearum*, either 48 hours before, simultaneously or 48 hours after the treatment. In contrast to other fungal candidates, *C. rosea* strain 016 completely inhibited the formation of perithecia as well as the discharge of ascospores. Investigations on the cellular level using a novel microfluidic platform, the "Fungal-Fungal Interaction device", suggest parasitism behind the observed activity of *C. rosea* against *F. graminearum*. Subsequently, field experiments were carried out in 2016/17 and 2017/18 to compare the efficacy of formulations of *C. rosea* strain 016 and *T. atrobrunneum* strain ITEM908. The collected data included *Fusarium* spore dispersal during the infection period, disease symptoms, mycotoxin content as well as the incidence of *Fusarium* species and *F. graminearum* DNA in harvested grains. The treatments with *C. rosea* strain 016 resulted in significantly lower FHB symptoms and reduced the deoxynivalenol (DON) content in harvested grains by up to 82% in the first and by up to 90% in the second year. Likewise, zearalenone (ZEN) was reduced by up to 80% in the first and by up to 90% in the second year. Treatments with *T. atrobrunneum* ITEM908 showed high variability between years. While no significant reductions were found in the first year, DON and ZEN were reduced by up to 80 and 90% in the second year. The great potential of *C. rosea* to reduce FHB will be further investigated in on-farm experiments.

MB-10 Combining nanomaterials and phages for enhanced bacterial wilt control

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Ralstonia solanacearum is plant-pathogenic bacterium caused bacterial wilt disease in a wide range of plant hosts. We proposed bacteriophage therapy as one of the most promising approaches to control this bacterium in our previous experiments. However, the application of the bacteriophage trophy for plant disease control is currently hindered by pathogen resistance development to bacteriophages and the limitation of movement within plant tissues. The goal of our study is to produce an enhanced virulence synthetic bacteriophage consortium against *Ralstonia solanacearum*, by combining phage trophy and nano-technology. Our results showed that the combination of bacteriophage and silicon nano-particle decreased the ability of bacteria evolving resistant to bacteriophage during the course of evolution, in vitro. We have tested this combination in roses plants under greenhouse condition and showed higher resistance and less disease severity in host plants. We concluded that the combination of nanomaterials and phages can be an effective biocontrol agent to protect the crop plants against phytopathogenic bacteria in agriculture and horticulture.