Factors influencing the fate of human pathogens in the plant environment

Eva Fornefeld[1], Ute Zimmerling[1], Kornelia Smalla[1]
[1] Julius Kühn-Institut, Federal Research Centre for Cultivated Plants, Institute for Epidemiology and Pathogen Diagnostics, Braunschweig
Email of corresponding author: eva.fornefeld@jki.bund.de

Fresh fruits and vegetables contaminated with human pathogenic bacteria can cause illnesses. As foodborne outbreaks associated with fresh produce are a growing concern, there is a need to further analyse the dissemination of human pathogens to plants and their persistence in the plant environment. The factors influencing survival need to be better understood aiming at optimisation of agricultural practices and possibly reducing outbreaks of produce associated illnesses.

Here, we analysed the influence of the factors preadaptation and the presence of sludge as a fertilizer on the survival of *Salmonella* in soil. In a greenhouse experiment *Salmonella enterica* LT2, was applied to soil and its survival was monitored. The experiment included six different treatments: soil amended with sludge or not and each inoculated with (i) *Salmonella*, (ii) preadapted *Salmonella* or (iii) no inoculums. Soil was sampled regularly and numbers of *Salmonella* were monitored using culture-dependent and -independent methods. The *Salmonella*-CFU decreased from about 10^6 to 10^3 per g dry soil within five weeks. Direct plating showed significantly higher numbers of *Salmonella* in the treatment with preadapted Salmonella without sludge compared to the other treatments from 10 days after inoculation (dpi).

The significant differences were confirmed using qPCR for 14 and 21 dpi. *Salmonella* was detected in soils 98 dpi using PCR-Southern blot hybridization and after 119 days using enrichment culture and plating.

Furthermore the effect of sludge on the soil microbiome was analysed. Bacterial communities were compared by denaturing gradient gel electrophoresis (DGGE). 16S fingerprints showed a strong influence of sludge on the bacterial community of soil. Inoculated samples showed distinct *Salmonella*-bands at 0 dpi which were weaker at 21 dpi. Soil samples were also analysed with regard to abundance of mobile genetic elements like class 1 integrons and genes conferring resistances to antibiotics or disinfectants which were detected at similar levels in all soil samples indicating that sludge did not have an effect on their abundance.

The results indicate that the factor preadaptation promoted survival of *Salmonella* in soil and show a lower survival of *Salmonella* in the presence of sludge. Despite of a rapid decline of Salmonella in soil our data showed a long term survival at low abundance.